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CITY OF SUNNYVALE

MASTER PLAN AND PRIMARY TREATMENT DESIGN

TECHNICAL MEMORANDUM

FLOW AND LOADS EVALUATION: MASTER PLAN

FINAL
October 2013

carollo in association with HDR

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CITY OF SUNNYVALE

MASTER PLAN AND PRIMARY TREATMENT DESIGN

TECHNICAL MEMORANDUM
FLOWS AND LOADS EVALUATION:
MASTER PLAN

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FLOWS AND LOADS: MASTER PLAN

1.0 INTRODUCTION

This technical memorandum (TM) presents an evaluation of historical wastewater flows and carbonaceous biochemical oxygen demand (CBOD), total suspended solids (TSS) and ammonia loads entering the City of Sunnyvale's Water Pollution Control Plant (WPCP). Historical flows and loads are used to establish flow and load projections that form the basis of planning and design for alternatives developed in subsequent memoranda.

2.0 PLANNING BASIS

The flow and load projections developed in this TM are based on an analysis of historical data from 2000 through 2012, which provided the basis for developing flow and load peaking factors and load per-capita values. Flow and loads are projected by two different methods. Average dry weather flows (ADWFs) were projected in the Collection System Master Planning process. Peak flows are projected by applying the developed peaking factors to projected ADWF. Loads are projected by applying the developed per-capita values and peaking factors to projected populations. This section summarizes the definitions used throughout the TM and the projected ADWF and populations.

2.1 Definitions

The following definitions are used throughout this TM:

- ADW / ADWF: Average Dry Weather / Average Dry Weather Flow. The ADWF period is set for each year as the three-month period between June and September that produces the minimum flow. The ADWF is the average of the daily average flow during this three-month period. ADW loads are calculated for each year based on the periods set for flow, and are the average daily loads during this three-month period.
- AA/AAF: Average Annual / Average Annual Flow. AA loads and AAF are the average of the average daily flow or loads for each calendar year.
- MM / MMF: Maximum Month / Maximum Month Flow. MM loads and MMF for a given year are the maximum 30-day running average of the average daily flow or load data.
- MW / MWF: Maximum Week / Maximum Week Flow. MW loads and MWF for a given year are the maximum 7-day running average of the average daily flow or load data.
- PD / PDF: Peak Day / Peak Day Flow. PD loads and PDF for a given year are the maximum daily average flow and load.
- PHF: Peak Hour Flow.

2.2 Projected ADWF and Population

The City sent Carollo Engineers (Carollo) their Draft Land Use and Transportation Element (LUTE) on July 11, 2013, which is summarized in Table 1. In this communication, the City indicated that they considered buildout for the WPCP to be the year 2035. The 2035/buildout data shown in Table 1 was used to project population and ADWF.

TM4 of the *Wastewater Collection System Master* Plan (IEC, 2012), used the City's collection system current flow data to developed flow duty factors for the different zoning classifications throughout the collections system. The average residential duty factor was 148 gpd/unit and the average non-residential duty factor was 140 gpd/1000 sf. TM 4 used the 2007 ABAG projections for the year 2035. The City is currently in the process of updating their Land Use and Transportation Element (LUTE) and has developed revised year 2035 projections for non-residential area and housing units to the values shown in Table 1. Using the average residential and non-residential duty factors developed in TM 4 and the Draft LUTE non-residential area and housing units projections shown in Table 1, the ADWF was projected to be 19.5 mgd by the year 2035/buildout. This value and methodology was agreed on by the City at a meeting on August 1, 2013 (meeting notes in Appendix A).

Table 1 City of Sunnyvale Housing and Jobs Projections (Draft LUTE)
Master Plan and Primary Treatment Design
City of Sunnyvale

	Existing Conditions	Buildout
Population	141,000	174,600
Housing Units	55,400	72,160
Industrial / Office / Commercial (million sf)	46.7	63.1
Jobs	77,890	132,000
Jobs to Housing Units Ratio	1.41	1.83

3.0 FLOW

The historic and existing sewer flows were analyzed for the years 2000 through 2012 and used to calculate the flow peaking factors. Flow projections were developed using current flows and anticipated community growth. This section describes the current and projected flows.

3.1 Historical Data

The influent meter measures the wastewater conveyed to the WPCP from the collection system plus digester decant return. Other recycle flows generated in the plant (including the filter backwash, thickening and dewatering/drying return) are sent directly to the ponds and do not impact the influent sample location. The digester decant return is estimated to be

around 36,000 gpd, or about 0.3 percent of the current ADWF and therefore has no significant impact on the influent flow measurements.

The ADWF was projected as noted previously. Historical and current flow data was analyzed to determine the flow peaking factor for AAF, MMF, MWF and PDFs. Flow peaking factors were developed for each year. Table 2 shows the flow peaking factors used in the SIP, used for neighboring City's (the City of San Mateo, City of Palo Alto and the City of San Jose), the maximum peaking factors for the years 2000 through 2012 and the maximum peaking factors for the years 2010 through 2012. This information was presented to the City at meeting on July 11, 2013 (meeting notes in Appendix B). Upon Carollo's recommendation, it was decided to select the maximum peak factors from the years 2000 through 2012 (shown in red) as these peaking factors are similar to those used in the SIP and similar to those peaking factors used by their neighboring agencies. For PHF, the SIP used a PHF peak factor of 3.0. The City provided Carollo with one year of hourly flow data (7/13/2012 – 7/12/2013) and during this year, the PHF peak factor was only 2.57. To be conservative, it was decided to use the higher PHF peak factor of 3.0 from the SIP.

Table 2 Flow Peaking Factors
Master Plan and Primary Treatment Design
City of Sunnyvale

	SIP	SM/PA/SJ	Max 2000 - 2012	Max 2010 – 2012
AA / ADWF	1.08	1.13/1.06/1.03	1.08 (avg = **1.05**(1))	1.05 (avg = 1.04(1))
MM / ADWF	1.34	1.51/1.38/1.17	**1.35**	1.25
MW / ADWF	1.46		**1.62**	1.41
PD / ADWF	1.92		**2.05**	1.78
PH / ADWF	**3.00**	--/2.9/2.7		2.57(2)

Notes:
(1) Used the Average
(2) Data only available from 7/13/2012 – 7/11/2013
SM = San Mateo, PA = Palo Alto, SJ = San Jose
Data shown in red indicate selected peaking factors.

3.2 Flow Projections

The AAF, MMF, MWF, PDF and PHF are projected by applying the peaking factors developed in Table 2 to the projected ADWF summarized in Table 1. Table 3 summarizes the current and projected flows for 2010, 2015, 2025 and 2035/buildout. The ADWF and MMF projections are also shown in Figures 1 and 2.

Table 3 Flow Projection Master Plan and Primary Treatment Design City of Sunnyvale				
Flow, mgd	**2010 (projected)**	**2015**	**2025**	**2035/Buildout**
ADWF	13.2	14.5	17.0	19.5
AAF	13.8	15.2	17.8	20.4
MMF	17.8	19.5	22.9	26.2
MWF	21.3	23.4	27.4	31.5
PDF	27.1	29.7	34.8	40.0
PHF	39.6	43.4	50.9	58.5

4.0 TSS

The historic and existing sewer TSS loads were analyzed for the years 2000 through 2012 and used to calculate the per capita loads and load peaking factors. Load projections were developed using current loads and anticipated community growth. This section describes the current and projected TSS loads.

4.1 Historical Data

The SIP Peer Review process identified that the influent sampler was in a non-ideal location, which resulted in artificially low TSS measurements. In 2010, the City moved their influent sample location and observed a marked increase in influent concentrations. Subsequent analysis of the current influent sample location by Carollo found that the new sample location is also non-ideal and could be resulting in artificially high measurements. Taking into account the uncertainties in the influent TSS data, per capita TSS loads are determined for 2011 and 2012 by dividing the ADW loads by the yearly population estimates provided by the City. As mentioned for flow, the influent TSS measurements include TSS from the decant return. This is estimated to represent up to 6 percent of the measured influent TSS load, and thus the estimated impact of the digester decant return was subtracted from the measured ADW influent TSS loads prior to calculating the per-capita loads.

Table 4 compares the measured influent TSS per capita loads from 2011 and 2012 with data from surrounding communities, the SIP and the SIP peer review process. Prior to the influent sampler move, the City's influent TSS per capita load was 0.13 ppcd, after the influent sampler was moved the City's influent TSS per capita load jumped to 0.19 ppcd. At the Data Review meeting on June 27, 2013 (meeting notes in Appendix C), Carollo recommended using a 0.19 ppcd per capita load (shown in red in Table 4), as it is similar to surrounding communities and is within the typical expected range. The higher value used during the SIP Peer Review process was not selected as preliminary evaluation of the current sampling point indicated that this sampling location is probably overestimating solids concentrations.

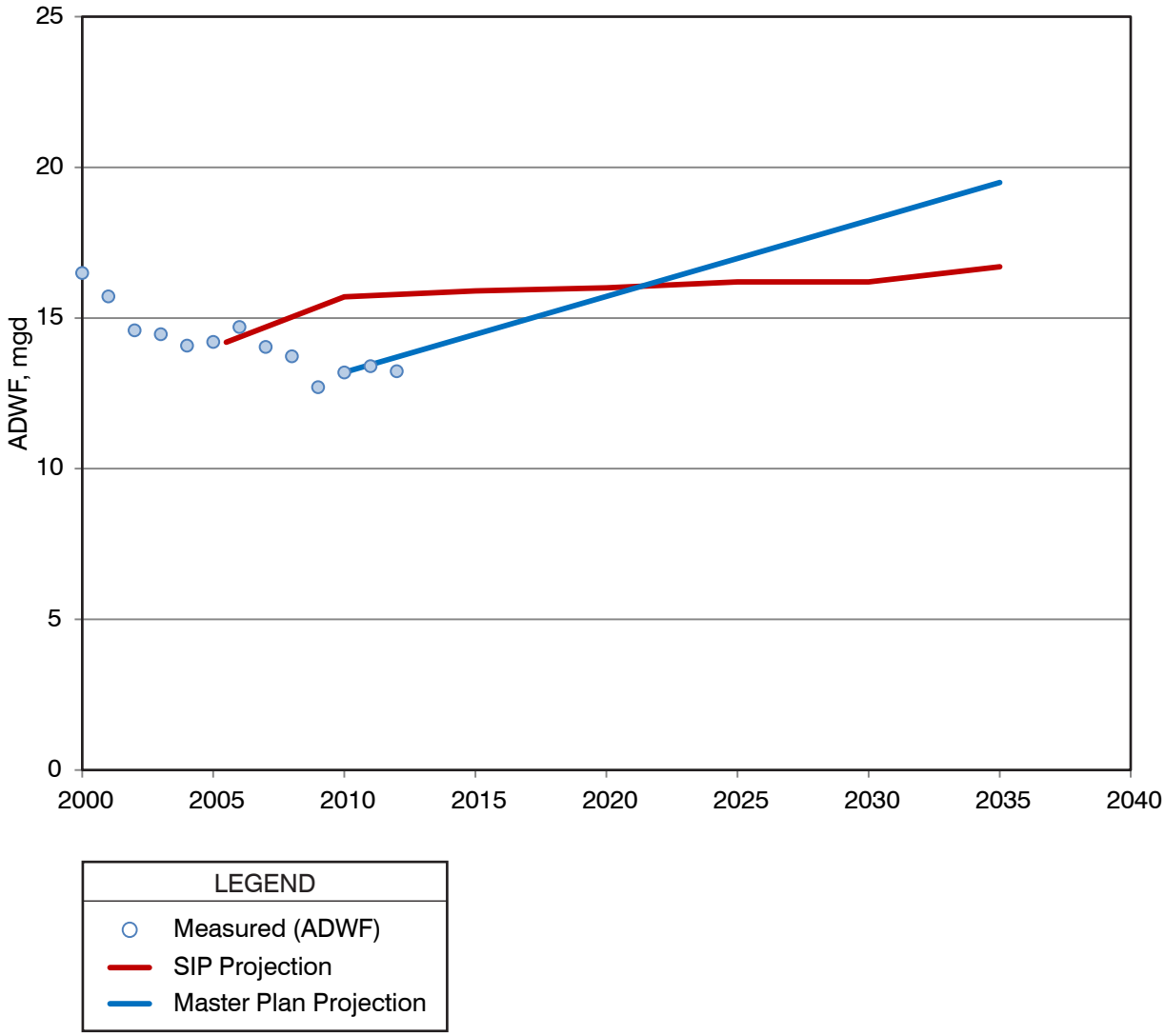

Figure 1
ADWF PROJECTION
FLOW AND LOADS EVALUATION
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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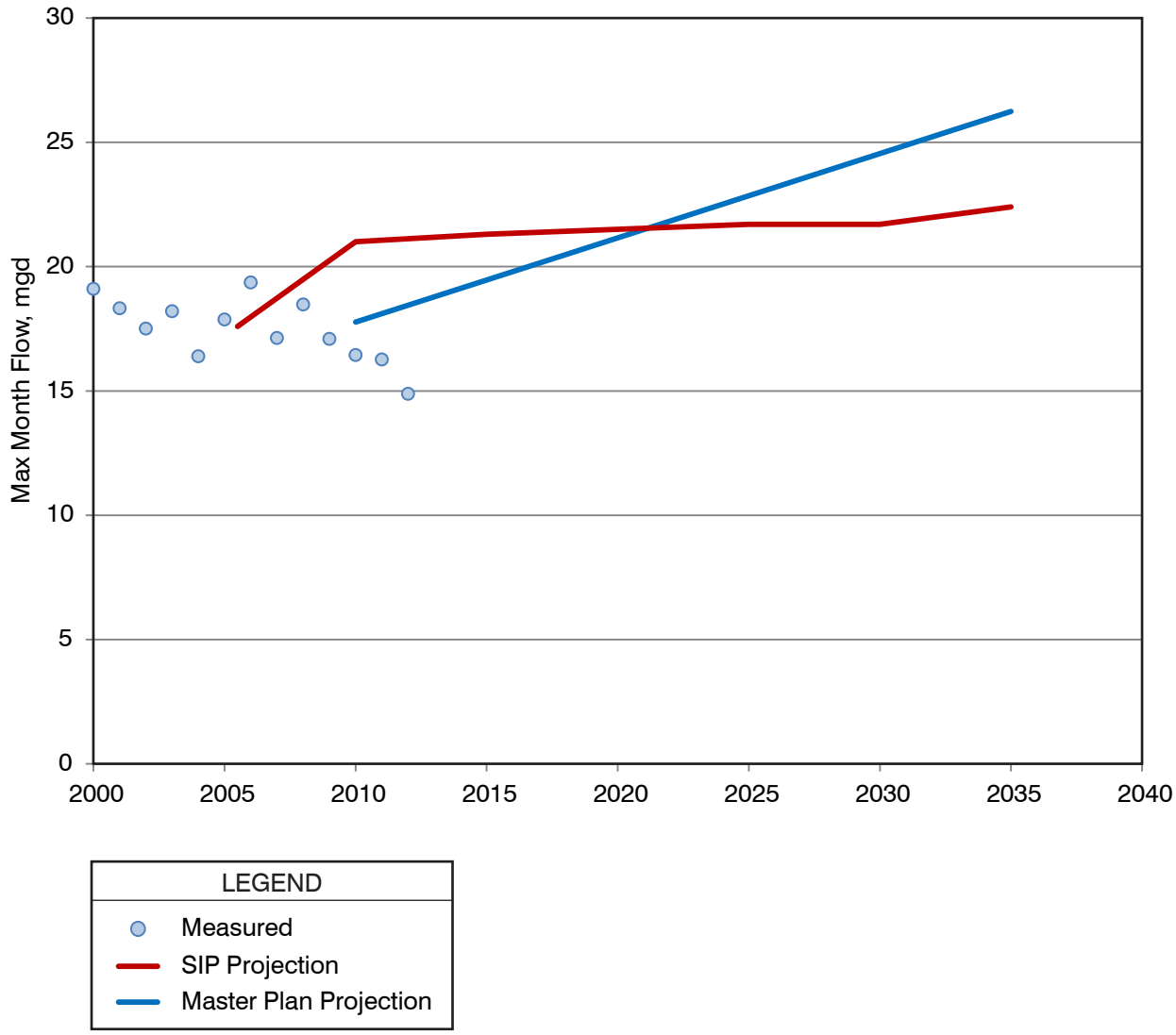

Figure 2
MMF PROJECTION
FLOW AND LOADS EVALUATION
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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Table 4 TSS Per Capita Load Comparison Master Plan and Primary Treatment Design City of Sunnyvale	
Facility	**Per Capita TSS Load, ppcd**
West County	0.22
San Mateo	0.21
Sunnyvale – SIP Peer Review	0.21
Sunnyvale – 2011 – 2012 Data	**0.19(1)**
Palo Alto	0.19
San Jose	0.19
Sunnyvale -- SIP	0.13

Notes:
(1) Backed out impact of decant return on influent sample.

Historical and current TSS load data was analyzed to determine the load peaking factor for AA, MM, MW and PD. Load peaking factors were developed for each year. Table 5 compares the peaking factors used in the SIP, used for neighboring agencies, the maximum peaking factors for the years 2000 through 2012 and the maximum peaking factors for the years 2011 and 2012. The year 2010 peak factor of 2.16 was not included in the analysis of recent peak factors since a sewer-flushing program implemented that year could have resulted in artificially high TSS values. This information was presented to the City on July 11, 2013 (meeting notes in Appendix B) and due to the uncertainties in the City influent TSS data and Carollo's recommendation, it was decided to use the peaking factors recommended in the SIP Peer Review (shown in red). The AA / ADW peaking factor recommended in the SIP and SIP Peer Review was higher than the surrounding agencies. Based on our experience at other facilities and the data shown in Table 5 for the surrounding communities, the average peak factor from 2000 through 2012 was selected as a basis of planning.

Based on feedback from Carollo, the City is planning to move the location of their influent sampler again to a location that will provide a more representative influent sample. Once the City begins to collect data at this location, the per capita loads and load peaking factors selected for TSS could be refined.

4.2 Load Projections

The AA, MM, MW and PD TSS loads were projected by applying the peaking factors developed in Table 5 to the projected population summarized in Table 1. Table 6 summarizes the current and projected TSS loads for 2010, 2015, 2025 and 2035/buildout. The MM TSS load projections are also shown in Figure 3.

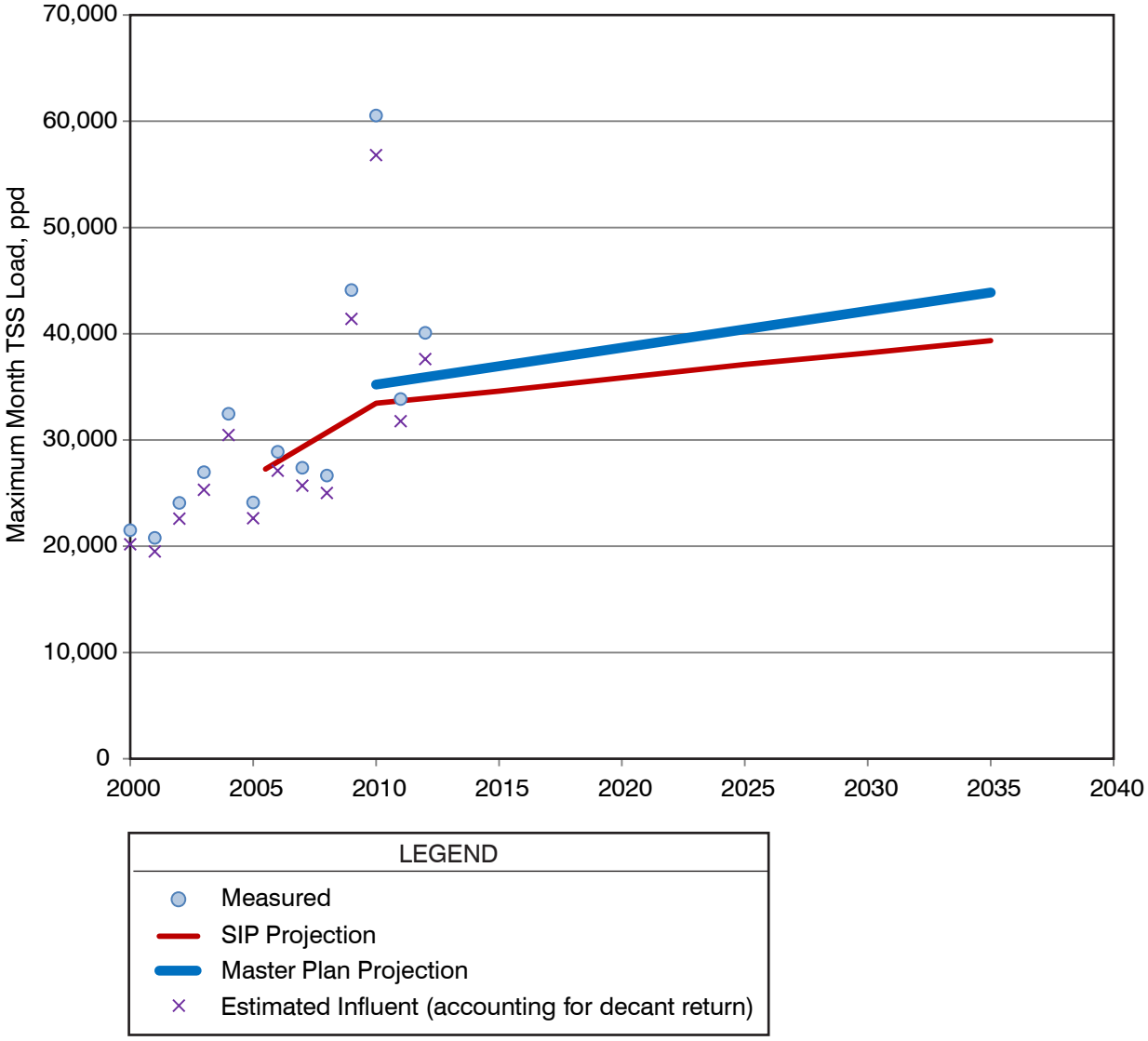
Table 5 TSS Load Peaking Factors
Master Plan and Primary Treatment Design
City of Sunnyvale

	SIP	SIP Review	SM/PA/SJ	Max 2000 - 2012	Max 2011 – 2012
AA / ADW	1.19	1.2	1.03/--/1.11	1.35 (avg = **1.07**[(1)])	1.06 (avg = 1.06[(1)])
MM / ADW	1.81	**1.3**	1.15/1.31/1.41	2.99	1.38[(2)]
MW / ADW	2.83	**1.5**	--/--/1.61	4.26	1.60[(3)]
PD / ADW	4.60	**2.5**	--/--/1.71	5.86	2.22

Notes:
(1) Used the Average
(2) The maximum 30-day running average TSS load for 2011 occurred on January 1, 2011 and included 29 data points from the year 2010. Including this data resulted in a MM PF of 1.63. Since 2010 data for TSS has been excluded due to the sewer flushing program that occurred that year, the 30-day running average for 2011 was started on January 30, 2011.
(3) The maximum 7-day running average TSS load for 2011 occurred on January 1, 2011 and included 6 data points from the year 2010. Including this data resulted in a MW PF of 1.80. Since 2010 data for TSS has been excluded due to the sewer flushing program that occurred that year, the 7-day running average for 2011 was started on January 7, 2011.
Data shown in red indicate selected peaking factors.

Table 6 TSS Load Projection
Master Plan and Primary Treatment Design
City of Sunnyvale

TSS Load, ppd	2010 (projected)	2015	2025	2035/Buildout
ADW	27,000	28,000	31,000	34,000
AA	29,000	31,000	33,000	36,000
MM	35,000	37,000	40,000	44,000
MW	41,000	43,000	47,000	51,000
PD	76,000	80,000	87,000	95,000



NOTE:
The jump in data from 2009 through 2012 was a result of the change in location of the influent sampler. The high data from 2010 was most likely a combination of the change in sampler location and a sewer flushing program.

Figure 3
MM TSS LOAD PROJECTION
FLOW AND LOADS EVALUATION
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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5.0 CBOD

The historic and existing sewer CBOD loads were analyzed for the years 2000 through 2012 and used to calculate the per capita loads and load peaking factors. Load projections were developed using current loads and anticipated community growth. This section describes the current and projected CBOD loads.

5.1 Historical Data

Historical influent CBOD data was evaluated for the years 2000 through 2012. Issues associated with the influent sample location described previously in the TSS section also apply to the influent CBOD data. Taking into account the uncertainties in the influent CBOD data, per capita CBOD loads were determined for 2010 and 2012 by dividing the ADW loads by the yearly population estimates provided by the City. As mentioned for flow, the influent CBOD measurements include CBOD from the decant return. The impact of the digester decant return on the influent CBOD load was estimated to represent an insignificant fraction of the influent CBOD.

Table 7 compares the measured influent CBOD capita loads from 2011 and 2012 with data from surrounding communities, the SIP and the SIP peer review process. Prior to the influent sampler move, the City's influent CBOD per capita load was 0.16 ppcd, after the influent sampler was moved the City's influent CBOD per capita load jumped to 0.18 ppcd.

Table 7 CBOD Per Capita Load Comparison
Master Plan and Primary Treatment Design
City of Sunnyvale

Facility	Per Capita CBOD Load, ppcd
West County	~0.19 (BOD = 0.22) (1)
Sunnyvale – 2011 – 2012 Data	**0.18**
San Mateo	0.18
San Jose	~0.18 (BOD = 0.21) (1)
Palo Alto	0.17 (BOD = 0.20) (1)
Sunnyvale – SIP Peer Review	0.16
Sunnyvale -- SIP	0.16

Notes:
(1) Converted BOD to CBOD by dividing the BOD value by 1.17.

At the Data Review meeting on June 27, 2013 (meeting notes in Appendix C), Carollo recommended using a CBOD load per capita planning value of 0.19 ppcd. This value is similar to surrounding communities and is within the typical range.

Historical and current CBOD load data was analyzed to determine the load peaking factor for AA, MM, MW and PD. Load peaking factors were developed for each year. Table 8 compares the peaking factors used in the SIP, the SIP Peer Review, used for neighboring agencies, the maximum peaking factors for the years 2000 through 2012 and the maximum peaking factors for the years 2010 and 2012. This information was presented to the City on July 11, 2013 (meeting notes in Appendix B) and due to the uncertainties in the City influent CBOD data, Carollo recommended using the peaking factors recommended in the SIP Peer Review (shown in red). The AA peaking factor recommended in the SIP Peer Review was higher than the surrounding agencies and higher than the City's measured data. Therefore, the AA CBOD load peaking factor, the average peak factor from 2000 through 2012 was selected.

Table 8 CBOD Load Peaking Factors
Master Plan and Primary Treatment Design
City of Sunnyvale

	SIP	SIP Review	SM/PA/SJ	Max 2000 - 2012	Max 2010 – 2012
AA / ADW	1.06	1.2	1.01/--/1.12	1.18 (avg = **1.05**(1))	1.04 (avg = 1.01(1))
MM / ADW	1.43	**1.3**	1.11/1.25/1.56	1.94	1.47
MW / ADW	1.75	**1.5**	--/--/1.69	2.39	1.58
PD / ADW	2.38	**2.5**	--/--/1.83	2.91	1.93

Notes:
(1) Used the Average
Data shown in red indicate selected peaking factors.

Based on feedback from Carollo, the City is planning to move the location of their influent sampler again to a location that will provide a more representative influent sample. Once the City begins to collect data at this location, the per capita loads and load peaking factors selected for CBOD can be refined.

5.2 Load Projections

The AA, MM, MW and PD CBOD loads were projected by applying the peaking factors developed in Table 8 to the projected population summarized in Table 1. Table 9 summarizes the current and projected CBOD loads for 2010, 2015, 2025 and 2035/buildout. The MM CBOD load projections are also shown in Figure 4.

Table 9 CBOD Load Projection Master Plan and Primary Treatment Design City of Sunnyvale				
CBOD Load, ppd	**2010 (projected)**	**2015**	**2025**	**2035 / Buildout**
ADW	25,000	26,000	29,000	31,000
AA	26,000	28,000	30,000	33,000
MM	33,000	34,000	37,000	41,000
MW	38,000	40,000	43,000	47,000
PD	63,000	66,000	72,000	78,000

6.0 AMMONIA

The historic and existing sewer ammonia loads were analyzed for the years 2000 through 2012 and used to calculate the per capita loads and load peaking factors. Load projections were developed using current loads and anticipated community growth. This section describes the current and projected ammonia loads.

6.1 Historical Data

Issues associated with the influent sample location described previously in the TSS section do not apply to the influent ammonia data, since ammonia is a soluble substrate.

Per capita ammonia loads were determined for 2010 and 2012 by dividing the ADW loads by the yearly population estimates provided by the City. As mentioned for flow, the influent ammonia measurements include ammonia from the decant return. The decant return is estimated to represent approximately 7 percent of the influent ammonia load and thus was discounted from the measured influent ammonia concentrations.

Table 10 compares the measured influent ammonia capita loads from 2011 and 2012 with data from surrounding agencies, the SIP and the SIP peer review process. At the Data Review meeting on June 27, 2013 (meeting notes in Appendix C), Carollo recommended using an ammonia load per capita planning value for 0.022 ppcd. This value is similar to surrounding communities and is within the typical range.

Historical and current ammonia load data was analyzed to determine the load peaking factor for AA, MM, and PD. Load peaking factors were developed for each year. Table 11 compares the peaking factors used in the SIP, SIP Peer Review, used for neighboring agencies, the maximum peaking factors for the years 2000 through 2012 and the maximum peaking factors for the years 2010 and 2012. Based on the information was presented at the meeting of July 11, 2013 (meeting notes in Appendix B), Carollo recommended using the maximum of the 2010 through 2012 peaking factor data as this was similar to their neighboring agencies and similar to the SIP Review suggested values.

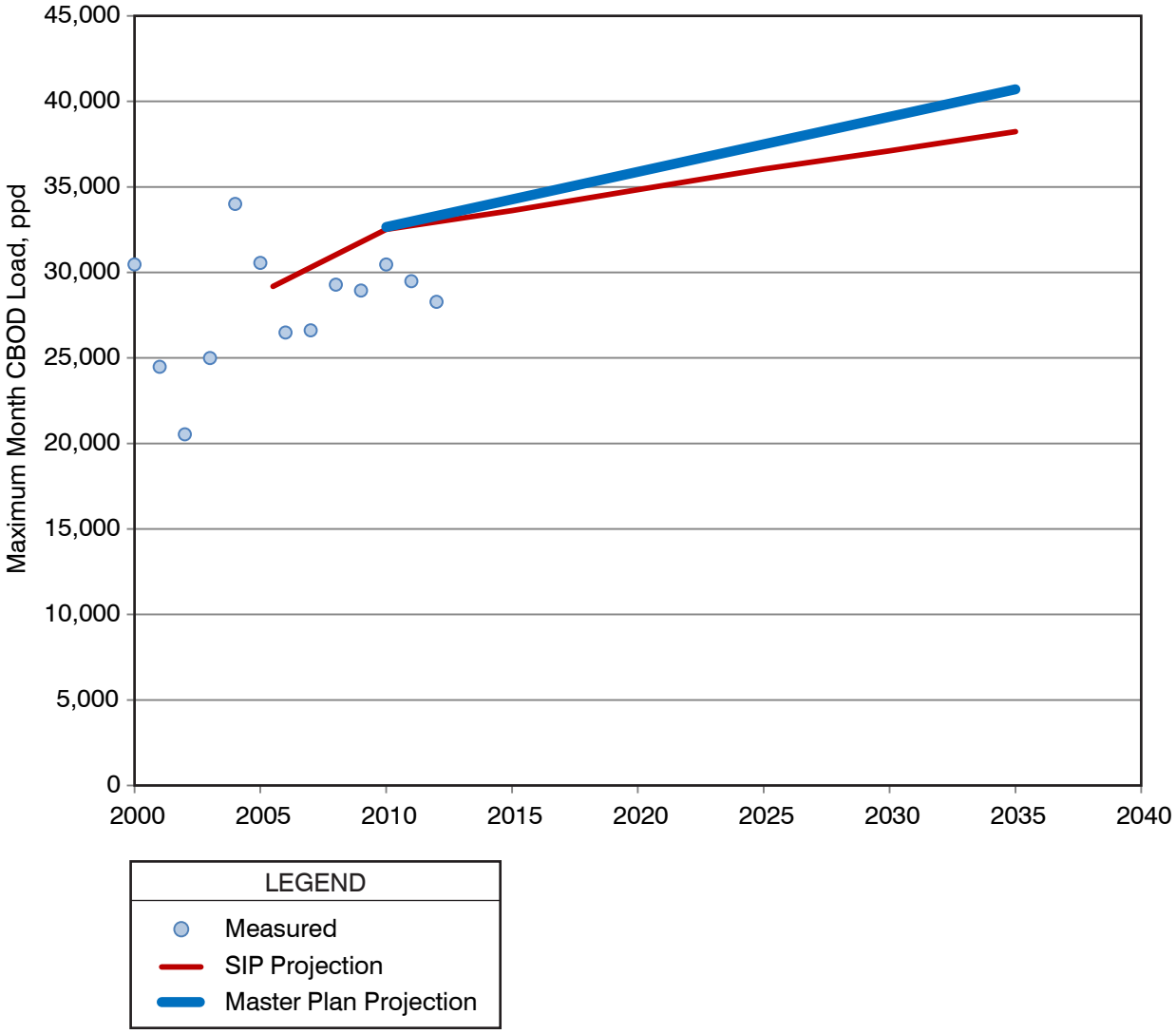

Figure 4
MM CBOD LOAD PROJECTION
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Table 10 Ammonia Per Capita Load Comparison Master Plan and Primary Treatment Design City of Sunnyvale	
Facility	**Per Capita Ammonia Load, ppcd**
Palo Alto	0.024
Sunnyvale – 2011 – 2012 Data	**0.022(1)**
Sunnyvale -- SIP	0.02
San Jose	0.018
Sunnyvale – SIP Peer Review	0.017
West County	0.016
Notes: (1) Backed out impact of decant return on influent sample.	

Table 11 Ammonia Load Peaking Factors Master Plan and Primary Treatment Design City of Sunnyvale					
	SIP	**SIP Review**	**SM/PA/SJ**	**Max 2000 - 2012**	**Max 2010 – 2012**
AA / ADW	1.23	1.2	--/--/1.09	1.07 (avg = 1.02(1))	1.06 (avg = **1.01**(1))
MM / ADW	1.46	1.3	--/1.23/1.31	**1.64**	**1.28**
PD / ADW	1.88	1.75	--/--/1.59	1.91	**1.58**
Note: (1) Used the Average Data shown in red indicate selected peaking factors.					

Additionally, the City has noticed a trend of increasing ammonia concentrations and per-capita loads from the years 2004 through 2007. The project team has speculated that this could be a result of non-residential growth outpacing residential growth. Since the City is projecting a large amount of non-residential growth, it was decided to select the maximum peak factor for 2000 through 2010 of 1.64 for MM to represent a high ammonia load scenario.

6.2 Load Projections

The AA, MM, MW and PD ammonia loads are projected by applying the peaking factors developed in Table 11 to the projected population summarized in Table 1. Table 12 summarizes the current and projected ammonia loads for 2010, 2015, 2025 and 2035/buildout. The MM ammonia load projections are also shown in Figure 5.

Table 12 Ammonia Load Projection Master Plan and Primary Treatment Design City of Sunnyvale				
Ammonia Load, ppd	**2010**	**2015**	**2025**	**2035/Buildout**
ADW	3,000	3,200	3,500	3,800
AA	3,100	3,200	3,500	3,800
MM (design)	3,900	4,100	4,500	4,800
MM (high)	5,000	5,200	5,700	6,200
PD	4,800	5,000	5,500	6,000

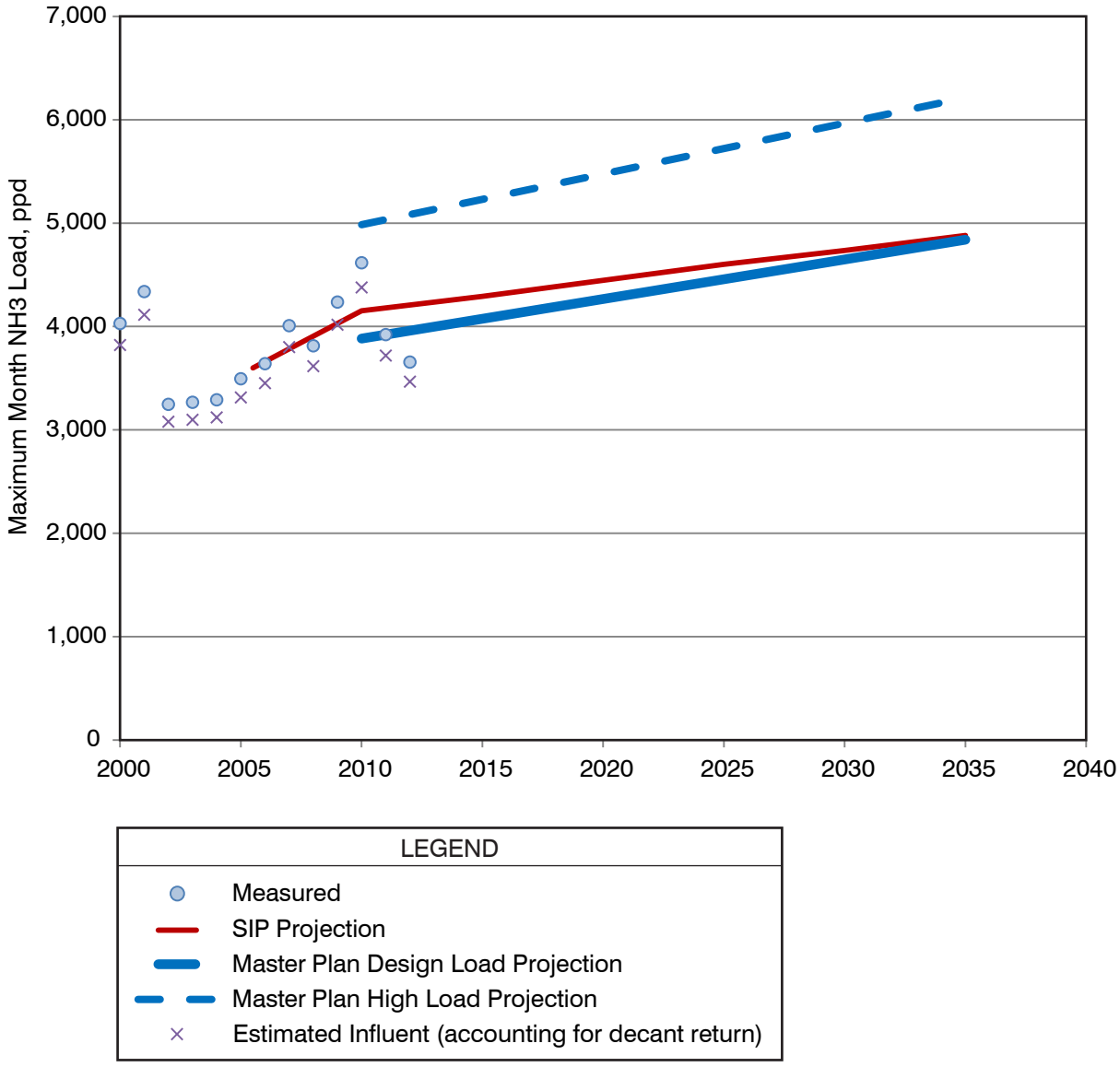

Figure 5
MM AMMONIA LOAD PROJECTION
FLOW AND LOADS EVALUATION
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CITY OF SUNNYVALE

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APPENDIX A – MEETING NOTES – AUGUST 1, 2013

Engineers...Working Wonders With Water™

CONFERENCE MEMORANDUM

Project:	Master Plan and Primary Treatment Design	**Conf. Date:**	August 1, 2013
Client:	City of Sunnyvale	**Issue Date:**	August 6, 2013
Location:	Sunnyvale City Hall Annex		
Attendees:	City: John Stufflebean, Bhavani Yerrapotu, Craig Mobeck, Melody Tovar, Trudi Ryan, Kent Steffens, Manuel Pineda, Tim Kirby	Carollo/HDR: Jamel Demir, Jim Hagstrom, Steve McDonald	
Purpose:	To make decisions on key wastewater planning and design flows		
Distribution:	Attendees, Jan Davel	**File:**	9265A.00 Task 112

Discussion:
The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

Purpose of Meeting

1. Craig - we want to reach conclusions on what we are planning for and what we are designing to.

2. Jim – the meeting will be a success if we can agree to set the flow values for certain flow definitions.

Definition of Flow Terms

1. Many of the terms are defined through CEQA and some are standard in the industry.

2. **Service Area Build Out Capacity** – the holding capacity of the service area considering land use and zoning.
   A. Importance: The importance of this flow term is as a check against the Plant Site Capacity limitation, in order to preserve space for future facilities.
   B. Discussion:
      1) Trudi -Not “Draft LUTE”, because we don’t plan for anything outside our urban service area (USA) boundary.
      2) Trudi – It does include Cupertino, and at some point it would be nice that we have a map that makes clear what area we are talking about.
      3) Rancho Rinconada is the only area outside the USA we serve now.
      4) A piece of Moffet AFB is in our sphere of influence, but not in our service area.

5) We serve the NASA facility now. There is a long-range plan that we can use now to make a decision on whether to include them in our potential sphere of influence.
6) Trudi – ok with rounding the nearest $0.1 million.
7) Jamel – Agree, we will be within +/- 0.5 mgd on our flows as well.

C. **Decision: This should match the GP capacity, (with some support to also consider a few other potential annexation candidates in the sphere of influence).**

3. **Plant Site Capacity** – the capacity that can fit on the existing site (assuming level of treatment).
   A. Importance: Very important in terms of 1) helping to set the phasing development, and 2) helping to justify the line-of-sight, setbacks, and other potential neighborhood issues, and 3) in comparing it to the Service Area BO, identifies any land constraints and the need for land acquisition.
   B. Discussion: Kent – are we going to consider using the pond footprint? ANS: probably not in terms of looking at treating the capacity in the master planning horizon.

4. **Plant Permitted Capacity** – the capacity that is in the NPDES permit.
   A. Importance: This is self-evident as it establishes the right to discharge treated effluent.
   B. Discussion:
      1) Trudi – the 29.5 mgd was established long ago when we had wet industries (e.g. canneries, etc.). Things have changed now.
      2) We cannot justify 29.5 mgd with the existing GP estimates, and it will likely be determined as growth inducing.
      3) Also, there are new total nitrogen requirements, and a new TMDL being developed. This will likely cap the plant at existing flows plus an allowance for growth.
      4) There will need to be a rating capacity.
   C. **Decision: The 29.5 mgd plant permitted capacity is not "real", and cannot be justified due to inconsistency with the GP, it exceeds the existing plant capacity, and due to pending nutrient regulations.**

5. **Treatment Plant Rated Capacity – the actual rating of the existing plant.**
   A. Importance: This establishes the basis of the performance of the WWTP, and is used to set rates, support the permit, and in approving new connections.
   B. Discussion: Unsure of the actual rated capacity of the existing facilities.
   C. **Decision: This will be done for the Phase 1 facilities.**

6. **Master Plan Capacity – This is the capacity that will be planned for in the 20-yr horizon.**
   A. Importance: This establishes the basis of all of the master planning alternatives, phasing, and costs.
   B. Discussion:
      1) Note; we want the GP to deal with the secondary impacts of the planned population, and the WWTP MP will be "accommodating" that plan.
      2) Trudi – there is a 35% density bonus that is available under law. We could increase our planned WWTP sizing. Agreed that there are significant CEQA implications to taking this approach, and probably not advisable.

3) Craig – when I talked to Trudi about what wasn't in the plan I got ~18.5 mgd. Basically, when looking at this different ways it confirms the ~17.5 to 19.5 mgd.

C. **Decision: Will use 19.5± mgd ADWF, consistent with the GP.**

7. **Phase 1 Design Capacity –** the capacities of each of the unit processes that are in the Phase 1 project.
   A. Importance: This establishes how far into the future that the project will accommodate projected wastewater flows, and sets the costs for the project.
   B. Discussion:
      1) There will likely be different capacities for different processes.
      2) For example, the Headworks is likely to be sized for the full 19.5 mgd, as it is difficult to phase out it using modular construction.
   C. **Decision: Will utilize 17± mgd ADWF for Phase 1.**

Impact on Finances

1. One issue is that the existing plant capacity is not really 29.5 mgd, but something less than that, and we need to be aware of that.

2. Another concern is whether the connection fees are appropriate considering that new capacity (at higher level of treatment and cost) must be built for new users.

3. Also, the question of "who pays" for the cost to go to nitrification/denitrification must be made when the TMDL is exceeded for TN. Is it the new users that bear all of added cost, or is it shared with existing users? The paradox is that under a TMDL limitation, the existing users would potentially never have to spend the money to reduce loadings, but if the costs all shift to new users it could be an unreasonable cost burden.

Cupertino Evaluation

1. John – one issue is whether we should consider, say accepting 6 mgd from Cupertino, where are we on the "economies of scale" and does that save us money for Sunnyvale? This opportunity is now, and should be assessed.

Action Items and Decisions

1. **Action Item: Carollo agreed to follow up with a "30,000 foot" assessment of the cost of Cupertino connecting to Sunnyvale, versus San Jose.**

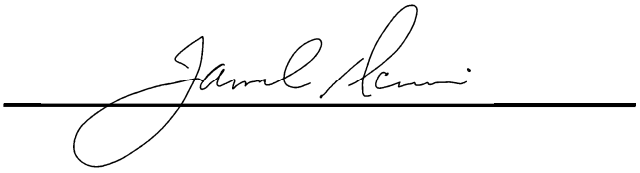
2. **Action Item: Carollo to follow up with the feasibility of pursuing a permitted capacity in excess of the plant rated capacity (i.e. getting 19.5 mgd permit for 16.7 mgd capacity).**

3. Action items and decisions added to Action and Decision Logs.

Attachments

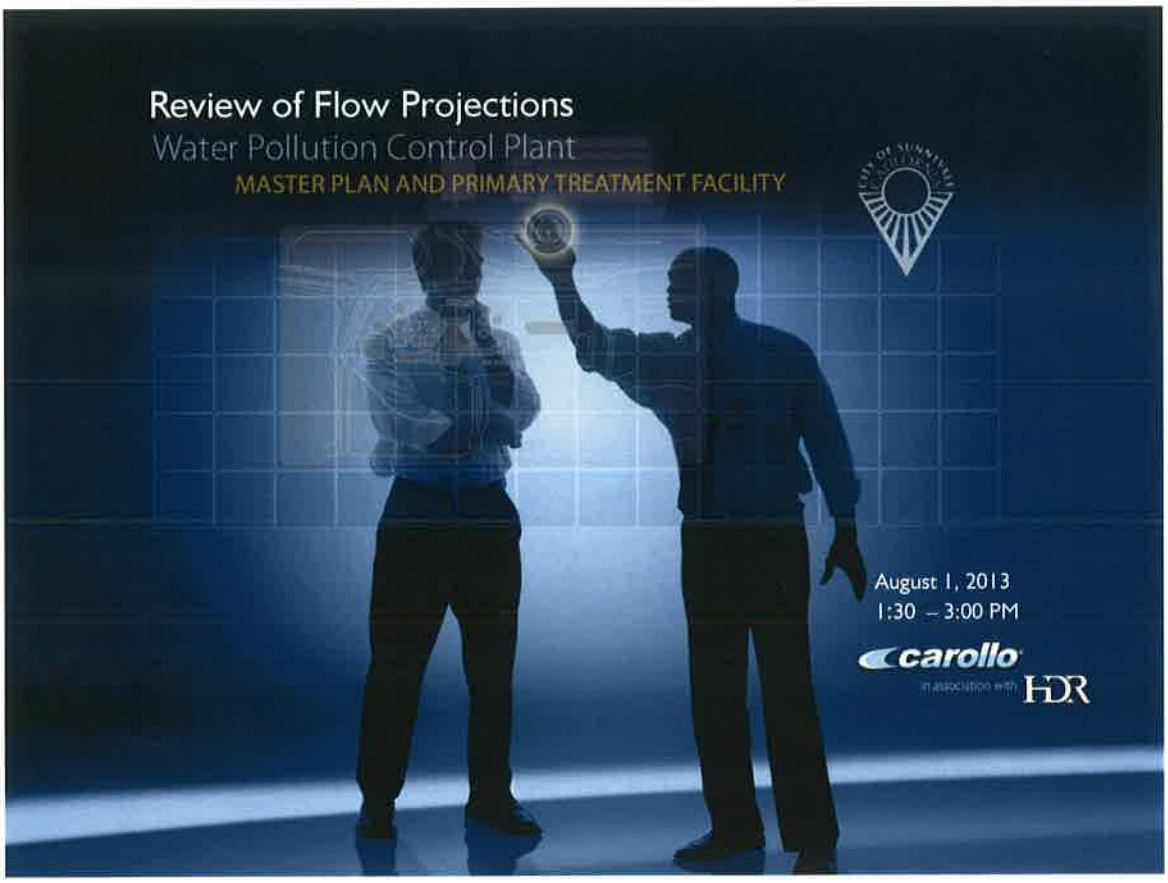
Presentation Slides

Prepared By:



Jamel Demir

JD:kr



Meeting will be a success if we…

- ✓ Establish the following….
  - Service Area Buildout Capacity
  - Plant Site Capacity
  - Master Plan Capacity
  - Phase I Design Capacity
- ✓ Understand impact potential of MP on funding

Agenda

- Introduction/Purpose
- Definition of flow terms
- Service Area Build-out Capacity
- Plant Site Capacity
- Plant Permitted/Rated Capacity
- Master Plan (MP) Capacity
- Phase I Design Capacity
- Impact on Finances
- Review of Action Items

Definition of flow capacity terms

- Service Area Buildout Capacity – The ultimate land development and population holding capacity within the City's service area, and the associated wastewater generated (which includes residential, commercial and industrial zoning assumptions)
- Plant Site Capacity – The wastewater treatment capacity that can be achieved based on available site space and key planning assumptions (i.e., water quality goals, space allocation for future processes – CECs, RO, etc.)

Definition of flow capacity terms (continued)

- Plant Permitted Capacity – The capacity to discharge as defined in the NPDES permit
- Treatment Plant Rated Capacity –The limiting process capacity rating for the overall plant based on the limiting process
- Master Plan Capacity – Based on 20-year planning horizon consistent with the City's General plan (with a check against Service Area Buildout Capacity)
- Phase 1 Design Capacities – The design capacities of the processes to be in the first phase of construction (different for a headworks vs. aeration basin)

Service area build-out capacity

Why this is important?

- Important in wastewater master planning because the capacity to treat for the ultimate build-out must be considered for the available site
- Depending on assumptions, site constraints can drive selection of process technologies
- Must be aligned with the General Plan estimated "buildout" so as not to be considered growth inducing

When do we need a decision?

- October 2014

Service area build-out capacity

We Recommend……..

- Service area build-out capacity = Master Plan Capacity
  - Draft LUTE (2035)=Ultimate Service Area Population

Plant site capacity

Why this is important?

- Important because it provides planning perspective on overall layouts
- Depending on assumptions, can drive selection of process technologies
- MP will determine if proposed build-out can be accommodated on the existing site

When will we determine?

- For the January 2014 workshop on site layout

Plant permitted capacity (currently established at 29.5 mgd)

- Different than 29.5 mgd design capacity identified in the current NPDES discharge permit, because:
  - CEQA review for the project will address 20-year planning values consistent with the General Plan
  - Capacity of WPCP will be revisited as part of the Regional Board's nutrient management plan for SF Bay (future TMDL)
  - There will need to be a rating study to demonstrate ability to discharge at 29.5 mgd under the next permit review

Treatment plant rated capacity

- The capacity rating of the existing facilities based on the ability to meet existing NPDES effluent requirements
- Forms the basis of the ability to discharge the Permitted Capacity

Master plan capacity

Why this is important?

- Important because it provides planning perspective on overall layouts as well as phasing assumptions
- Based on the proposed implementation plan, will provide input into long-term financial plan

When do we need a decision?

- Now

Our Programmatic EIR must be consistent with CEQA approved growth plans....

	Current	Build-out (2011 GP)	Build-out (Draft LUTE)
Population	141,000	159,500	174,600
Households	55,400	65,900	72,160
Jobs	77,890	160,000	132,000
Commercial area, million sf	46.7	49	63.1

This would suggest that our MP Capacity could range from 17.5 to 19.5 mgd

	2010 (Collection System Master Plan)	2010 (Planning Department)	2035 (Draft LUTE)
Residential			
Households, units	52,559	55,400	72,160
Duty factor, gpd/unit	148	132	132-148
BWF (ADWF), mgd	7.8	7.3	9.6
Non-Residential			
Area, millions sf	44.1	46.7	63.1
Duty factor, gpd/1000 sf	140	125	125-140
BWF (ADWF), mgd	6.2	5.9	7.9
Total BWF (ADWF), mgd	**14.0**	**13.2**	**17.5-19.5**

Master plan capacity

We recommend.....

- Use 19.5 mgd for the 20 year planning horizon

Phase 1 design capacity

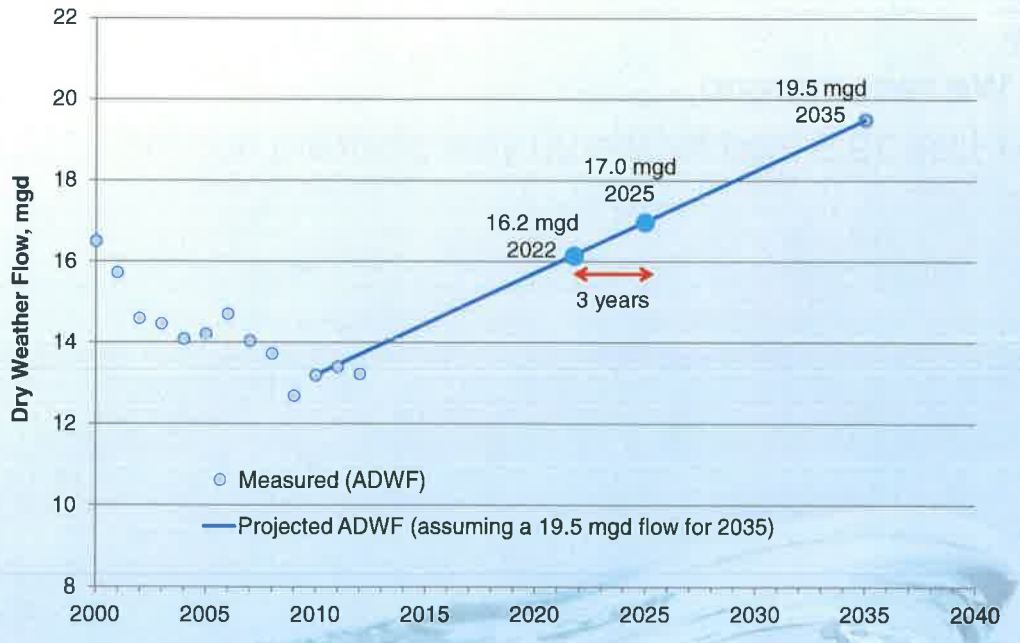
Why is this important?

- Important because it sets in-place the implementation and cash flow estimates
- Will vary based on each process
- Impacted by City's philosophy on implementing second phase (i.e., just-in-time vs. lag period between construction)

When do we need a decision?

- Preliminary selection – Now (to perform alt. analysis)
- Revisited and finalized as part of the implementation planning step in 2014

Approach to phasing design capacity



Phase 1 design capacity

We recommend…..

- Using 17.0± mgd as the first phase

Implications to this recommendation include…..

- A multi-phased implementation plan will be developed as part of the Master Plan (MP)
- 75% flow trigger may be reached shortly after headworks/primaries come on line
  - MP will be in place to address 75% flow trigger issues
  - Funding may need to be reconciled with the MP

Do these findings have an impact on the policy and procedures for the development of rates and connection fees?

- Existing plant capacity
- Future regulations with respect to ammonia/nitrogen
  - Total Nitrogen (TN) Agency Waste Load Cap (no net increase)
  - TN Aggregate TMDL Cap

End of Presentation

APPENDIX B – MEETING NOTES – JULY 11, 2013

Engineers...Working Wonders With Water™

CONFERENCE MEMORANDUM

Project:	Master Plan and Primary Treatment Design	**Conf. Date:**	July 11, 2013
Client:	City of Sunnyvale	**Issue Date:**	July 23, 2013
Location:	WPCP Conference Room		
Attendees:	City: Craig Mobeck, Bhavani Yerrapotu, Kapil Verma, Alo Kauravlla, Bryan Berdeen EOA, Inc: Ray Goebel	Carollo/HDR: Jim Hagstrom, Jamel Demir, Jan Davel, Anne Conklin	
Purpose:	Review flow and load projections.		
Distribution:	Attendees	**File:**	9265A.00

Discussion:
The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

Flow Projections

1. Craig: Planning Dept is looking at the non-residential population projections. We're afraid we may be double-counting using IEC's numbers. Jamel: You'll see their numbers in the projections today. It impacts the flows associated with the selected design year, which relates to how conservative or not that planning horizon might be. Because we plan to use flow triggers, the timing of the next phase of improvements will be driven by the actual future flows generated. Selecting a higher flow value for planning could impact the $318± million SIP estimate (emphasizes the need to codify the basis for this estimate as we move forward with other planning decisions).

2. Jim: From a cost-management perspective, this is really something we need to move on from. It can consume a lot of effort without necessarily making much difference to the confidence we have in these projections. Carollo is suggesting 1 to 2 weeks to try and wrap this up, so we can get started on the process design element of the project to get ready for the October workshop.

3. Bhavani: These are not precision facilities, e.g., 16.7 mgd facility may not operate at that capacity due to many factors. So, we need to ensure we have the safety factors built into our assumptions to accommodate this uncertainty.

4. Craig: We're not going to get any more data. So we should have time to have the necessary discussions to make those decisions. Bhavani: I'll talk to John about the urgency of us getting comfortable with the flow projections.

5. Jim: Even though we cannot agree on the projections today, I'd like us to have concurrence on the approach going forward, though. We already know the issues with the sampled data. If we go forward with what we have today, we can update based on additional information coming available potentially. **Action Item: City to meet in the next couple of weeks to determine basis of planning for master plan flows**.

6. Jim: We need to track the $318 million cost estimate for the project as we move forward and as potential impacts are identified. Agreed that this should be made part of the SIP Validation memo.

7. Anne: Dry Weather Flow Projections by IEC projections do not include groundwater infiltration (GWI), which would bump the projected numbers up slightly. Jim: It's an example of the uncertainty with flow projections. In planning we have to make an assumption in the end, and not on precise numbers. The vast majority of the IEC flow projection is comprised of non-residential flows (noted that residential population numbers are slightly lower than used in the SIP).

8. Kapil: This does not include any Cupertino flows. Anne: No, Cupertino and the Lawrence-specific plan are not included. Bhavani: This document should clearly document these assumptions. Also, if we decide to pick a lower number, we should make provision for the additions needed at higher flows. **Action Item: In the City's internal flow discussions, need to decide how to deal with the Cupertino flow additions**.

9. Anne: The slide shows the red box around the flows and loads that, at this point, suggest the accepted flows.

10. Anne: Developed peak factors based on your data, the SIP, and other South Bay facilities. Bhavani: The last 3 years show a drop in the MW/ADWF factor. The last 10 years capture wet and dry years, vs. the last 3 years only. **Decision: We should stick with the 1.35 peaking factor (consistent with Palo Alto which is 1.38).**

11. Anne: The overall impact on the MM flows is still higher than the SIP, because it is based on the higher 19.8 mgd number, even though the lower PF of 1.25 has been used. **Decision: City is comfortable with their flows, so we should use the full 12-year period for flow and load analysis.** Anne: Things change over such a long period, which can gradually skew the flow characteristics.

12. Jim: We're also particularly interested in the PH factor. Palo Alto's is 2.9, similar to the SIP assumptions. **Action Item: City to check with the ops staff and collections system staff on their knowledge of peak flows**. Bryan: That PF of 3.0 looks pretty good from what we've seen. **Decision: Will plan on using the 3.0 peak hour factor unless plant staff input changes it**. Using the 3.0 factor, the PH goes up to 55 mgd, which is 10% higher than the 50 mgd used in the SIP

Influent Sampling and Primary Sludge Review

1. Since the last Data Review meeting, Bob Gillette took a site tour of the raw sampling station and reviewed the approach used to collect primary sludge flow data. Discussed the following:
   A. Poor sampler location.

B. Previous sampler location right at water line. At lower flows not as representative as could be.
C. Sample line just dropped into the flow. Will orient with velocity: the faster the velocity, the line will float higher.PVC pipe above the water line where there's UV exposure.
D. Primary sludge pumping has a low density turn off, don't think they are hitting the low density turn off.
E. One sludge line has a flow meter on it.
F. Operators take directly off of Opto; record the run times from all meters.
G. Have a flow meter, put a Doppler on it.
H. Density meter has a flow meter on it. Looking into it. Check into scum fate.
I. Used to use digester cover level as a measure of flow to the digesters, can only do this on one digester.

2. **Decision: In lieu of WPCP-specific influent wastewater temperature data, Carollo to use data from adjacent plants. City to start collecting this data for the WPCP.**

Load Projections

1. Decant stream return to the headworks:
   A. Ray: As part of the sampling review, should try and improve the flow measurement approach, concentration, etc. All of this would help with the sludge balance closure, which we're not able to do at this point. We looked at different sludge removal efficiencies across the primaries, and consistently shows a very small impact on the raw influent stream of the decant. **Decision: We can move forward with the raw numbers. We can come back and check these numbers before completing the Basis of Design (BOD).**

2. TSS:
   A. Anne: Peaking Factors from SIP were high. Even if the sampler was measuring low, this would not impact the PFs. SIP Review suggested using a 1.3 factor, which agrees well with Palo Alto. Your data show higher numbers, even for the last two years.
   B. Anne: The recommended PFs bring your TSS load projections in between the SIP and 2011/2012 data. **Decision: We'll use the SIP Review numbers, and come back and validate after the sampling effort.**
   C. **Decision: The population numbers are not in contention; they're ABAG, we should use these.**

3. CBOD:
   A. The MM PF is really important for the secondary treatment system; the AA PF is important for the O&M calculations. Bhavani: It's important for the report to document the reasons behind using the PFs.
   B. The SIP Peer Review factors again fall between the SIP assumptions and your data. We're using a per capita that makes sense, matches industry standard, and matches your data best. **Decision: Use the SIP Peer Review factors.**

4. Ammonia:
   A. Anne: From the issues with your influent sampler, TSS is most affected, CBOD moderately so, and ammonia likely least impacted. Therefore, we have higher faith in your ammonia numbers.

B. SIP numbers were high, also based on real data up to 2007.
C. The employment data would give us a good way to see if the increase in per capita loads is likely to continue or whether it would flatten out. Bhavani: My sense is, based on the commercial growth in the area, that this increase in ammonia per capita might continue.
D. **Action Item: Kapil and Anne to evaluate the 2012 and 2013 ammonia numbers to see if the trend continues.**
E. We could use the 1.28 for the low growth, and a higher PF for a high-growth scenario. **Decision: For ammonia we should have a bracket at this point instead of a fixed projection**. Jim: Do we have the MM value for 2013 yet? **Action Item: Anne will check on 2013 values, to determine if the maximum month ammonia load occurs at a predictable time each year and to determine, if possible, if the maximum month ammonia load for 2013 has occurred.**
F. Anne: We've seen this phenomenon at other treatment plants across the country. Another theory is the reduction in per capita flows results in longer residence times in the sewers and higher ammonification. This would not give you an upper bound, because all of this nitrogen gets to the plant anyway.
G. If however it's related to non-residential growth instead, it would result in different discharge characteristics (it will be linked to the growth assumption i.e., 1 employee is 0.36*0.78, or 0.28 ERUs).
H. **Decision: Absent the non-residential population projections, we'll use the more-conservative 1.64 PF to generate the upper bracket.**
I. The AA/ADWF PF used in the SIP Review (1.2) is high; your data suggest 1.01 instead. **Action Item: Anne to send the raw data to Bhavani for this.** The grabs are higher, but probably more representative than the composite numbers.

Focused Sampling Effort

1. The 2-week sampling effort on primary influent and effluent is necessary for the influent wastewater characterization for the secondary treatment evaluation. The diurnal sampling is also used for that purpose, but allows dynamic modeling. This would give a better indication of expected performance.

2. This can only be performed once the influent sampler has been moved to the new location. Bhavani: I'd like us to perform this first on the existing location before we move the sampler.

3. The pond effluent and FGR effluent data would be good to have to support the City's operational decisions over the next 8 years until the new facilities are in place.

4. Bhavani: We need to do try to perform these tests within the same time period if possible.

5. COD is a very useful test to do on a regular basis, particularly to determine the VSS destruction around the digesters. **Action Item: Look into testing COD on a regular basis.**

6. Outstanding data:
   A. **Action Item: Kapil to send the nitrification test results as soon as possible.**
   B. **Action Item: Kapil to provide the peak flows.**

Action Items and Decisions

Added to the Action and Decision Logs.

Attachments

Presentation Slides

Prepared By:

J.L. Davel

JLD:jld

This Meeting will be a Success if …

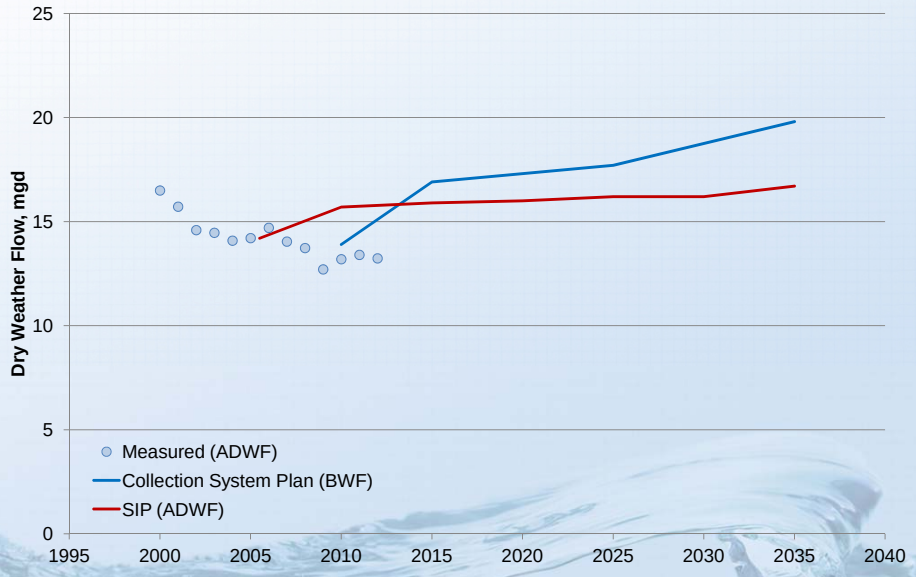
- ✓Agree on flow and load projections
- ✓Agree on sampling effort

Agenda

1. Review Flow Projections
2. Initial Assessment of Influent Sampling and Sludge Measurement
3. Review Load Projections
4. Review Proposed Focused Sampling Effort
5. Next Steps/Action Items

Flows

Dry Weather Flow Projections



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Flow Projections

Flow	2015	2025	2035
ADWF: SIP	15.9	16.2	16.7
BWF: Coll Sys MP (1,2)	*16.9*	*17.7*	*19.8*
AA			
MM			
MW			
PD			
PH			

Notes:
(1) Needs to be adjusted to include Ground Water Infiltration (GWI).
(2) Adjustment for Lawrence-specific plan *et al* not included.

ADWF = Average Dry Weather Flow
BWF = Base Wastewater Flow
AA = Average Annual
MM = Max Month
MW = Max Week
PD = Peak Day
PH = Peak Hour

6

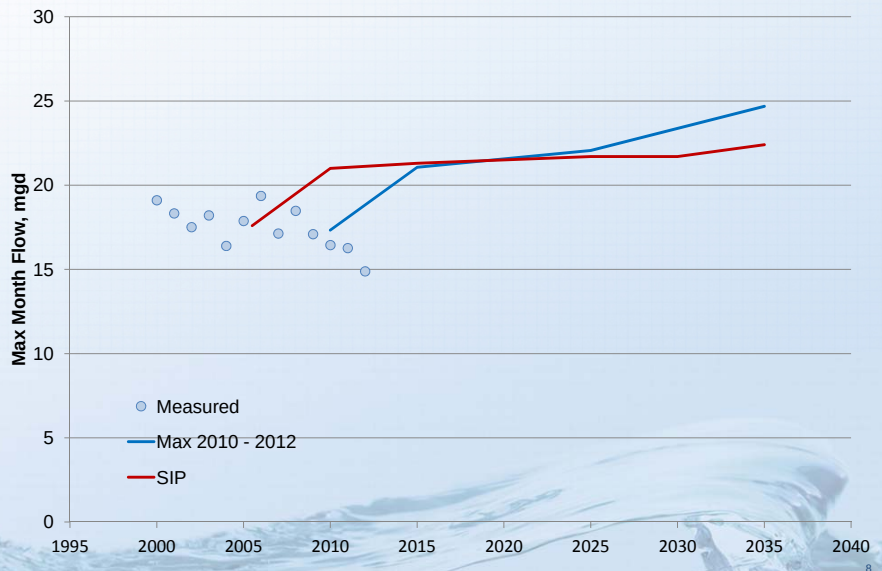
Flow Peaking Factors

	SIP	SM/PA/SJ	Max 2000 - 2012	Max 2010 - 2012
AA / ADWF	1.08	1.13/1.06/1.03	1.05(1)	1.04(1)
MM / ADWF	1.34	1.51/1.38/1.17	1.35	1.25
MW / ADWF	1.46		1.62	1.41
PD / ADWF	1.92		2.05	1.78
PH / ADWF	3.00	--/2.9/2.7	NA	NA

Notes:
(1) Used the average.

AA = Average Annual
ADWF = Average Dry Weather Flow
MM = Max Month
MW = Max Week
PD = Peak Day
PH = Peak Hour

Max Month Flow Projections



Flow Projections

Flow	2015	2025	2035
ADWF	16.9	17.7	19.8
AA	17.5	18.4	20.5
MM	21.1	22.1	24.7
MW	23.8	24.9	27.9
PD	30.1	31.5	35.3
PH	47.0	49.2	55.0

AA = Average Annual
ADWF = Average Dry Weather Flow
MM = Max Month
MW = Max Week
PD = Peak Day
PH = Peak Hour

Loads

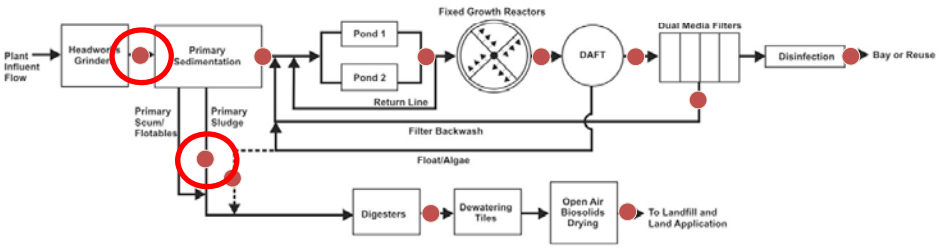
Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
TSS	0.2 ppcd	0.13 ppcd	0.20 ppcd
CBOD	0.17 – 0.2 ppcd	0.16 ppcd	0.18 ppcd
NH3	0.02 ppcd	0.02 ppcd	0.023 ppcd

From last meeting the following considerations:

- Bob Gillette's review of data sampling setup
- Digester decant stream discharges to the headworks
- Increasing per capita ammonia loads

Sampling Locations Reviewed



Observations from Sampling Review

- Influent Sampler:
  - Current and previous sampler locations not within well-mixed zone
  - Inlet at current location is deep, i.e., high TSS measurements
  - Inlet at previous location was shallow, i.e., low TSS measurements
  - To achieve better mixing, suggest relocating sampler further upstream to where the inlet pipes discharge and mixing occurs
  - Suggest that sampler tube (both in pump and to the weighted sample inlet) be changed at least quarterly and protected with PVC pipe to limit growth

Observations from Sampling Review
Continued

- Primary Sludge:
  - Concentrations and flows are questionable; very typical of WWTPs
  - Recorded flows are based on pump run times; pump capacity will be incorrect at least some of the time due to wear on rotor and stator
  - Operators manually start pumps periodically, and select run times based on experience and sludge judge readings, i.e., could be pumping more water and less sludge
  - Relying on density meter for concentrations, calibrated/adjusted based on occasional grab samples
  - Sludge density typically varies from start to stop of pump run

Observations from Sampling Review
Continued

- Primary Effluent Sampler (not inspected):
  - Suggest that sampler tube (both in pump and to the weighted sample inlet) be changed at least quarterly and protected with PVC pipe to limit growth

Comparison of Influent Data with Industry Parameters (Adjusted for decant)

Parameter	Default	SIP Data	2011-2012 Data	2011-2012 Data Revised
TSS	0.2 ppcd	0.13 ppcd	0.20 ppcd	0.19 ppcd
CBOD	0.17 – 0.2 ppcd	0.16 ppcd	0.18 ppcd	0.18 ppcd
NH3	0.02 ppcd	0.02 ppcd	0.023 ppcd	0.022 ppcd

Year	SIP Population	Collection System Master Plan Population
2015	143,598	143,688
2025	153,997	150,895
2035	163,300	158,105

TSS

TSS Projections

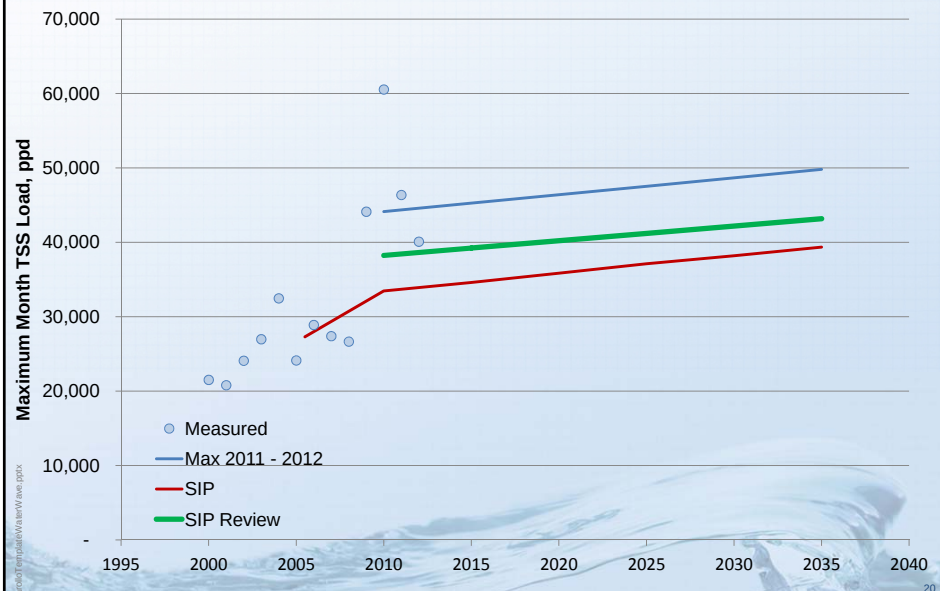
Flow	2015	2025	2035
ADW	28,000	29,000	31,000
AA			
MM			
MW			
PD			

TSS Peaking Factors

	SIP	SIP Review	SM/PA/SJ	Max 2000 - 2012	Max 2011 - 2012
AA/ADW	1.19	1.2	1.03/--/1.11	1.07(1)	1.06(1)
MM / ADW	1.81	1.3	1.15/1.31/1.41	2.99	1.63
MW / ADW	2.83	1.5	--/--/1.61	4.26	1.80
PD / ADW	4.60	2.5	--/--/1.71	5.86	2.22

Notes:
(1) Used the average instead of maximum.

Max Month TSS Projections



TSS Projections

Flow	2015	2025	2035
ADW	28,000	29,000	31,000
AA	33,000	35,000	37,000
MM	36,000	38,000	40,000
MW	42,000	44,000	46,000
PD	78,000	82,000	86,000

CBOD

CBOD Projections

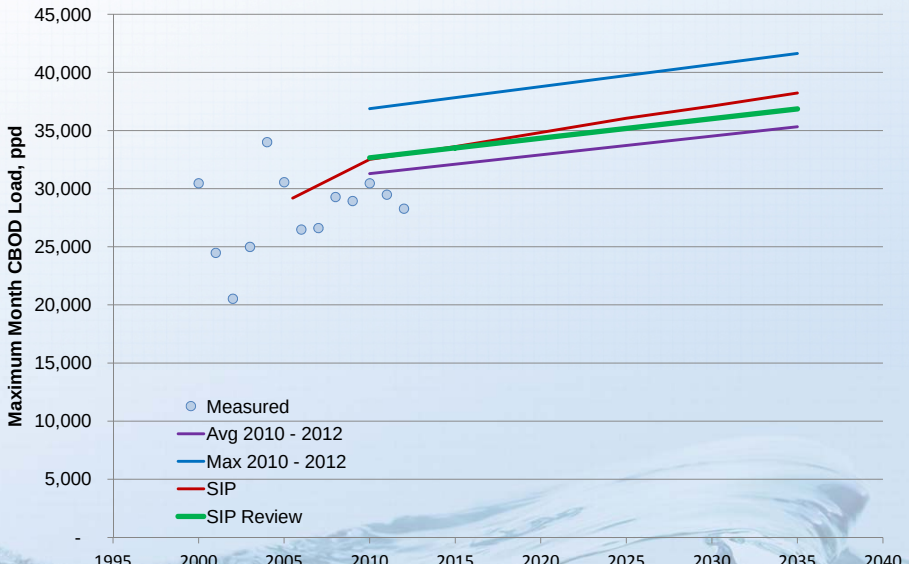
Flow	2015	2025	2035
ADW	26,000	27,000	28,000
AA			
MM			
MW			
PD			

CBOD Peaking Factors

	SIP	SIP Review	SM/PA/SJ	Max 2000 - 2012	Max 2010 – 2012
AA / ADW	1.06	1.2	1.01/--/1.12	1.05(1)	1.01(1)
MM / ADW	1.43	1.3	1.11/1.25/1.56	1.94	1.25(2)
MW / ADW	1.75	1.5	--/--/1.69	2.39	1.58
PD / ADW	2.38	2.5	--/--/1.83	2.91	1.93

Notes:
(1) Used the average.
(2) The max peaking factor from 2010 – 2012 of 1.47 from 2010 results in an unrealistically high projected load. Used the average peaking factor from the same period.

Max Month CBOD Projections



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CBOD Projections

Flow	2015	2025	2035
ADW	26,000	27,000	28,000
AA	26,000	27,000	29,000
MM	34,000	35,000	37,000
MW	41,000	43,000	45,000
PD	50,000	52,000	55,000

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Ammonia

Ammonia Projections

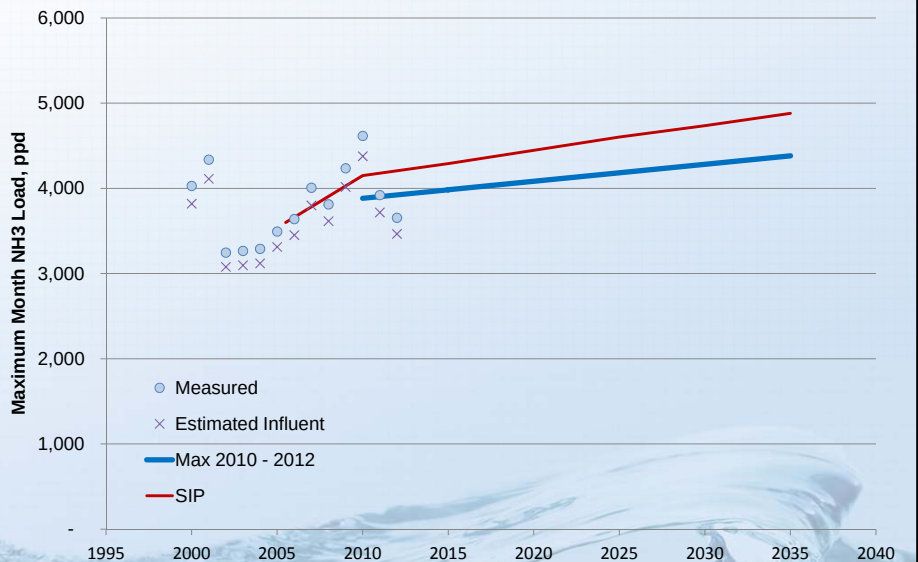
Flow	2015	2025	2035
ADW	3,100	3,300	3,400
AA			
MM			
PD			

Ammonia Peaking Factors

	SIP	SIP Review	SM/PA/SJ	Max 2000 - 2012	Max 2010 - 2012
AA / ADW	1.23	1.2	--/--/1.09	1.02(1)	1.01(1)
MM / ADW	1.46	1.3	--/1.23/1.31	1.64	1.28
PD / ADW	1.88	1.75	--/--/1.59	1.91	1.58

Notes:
(1) Used the average.

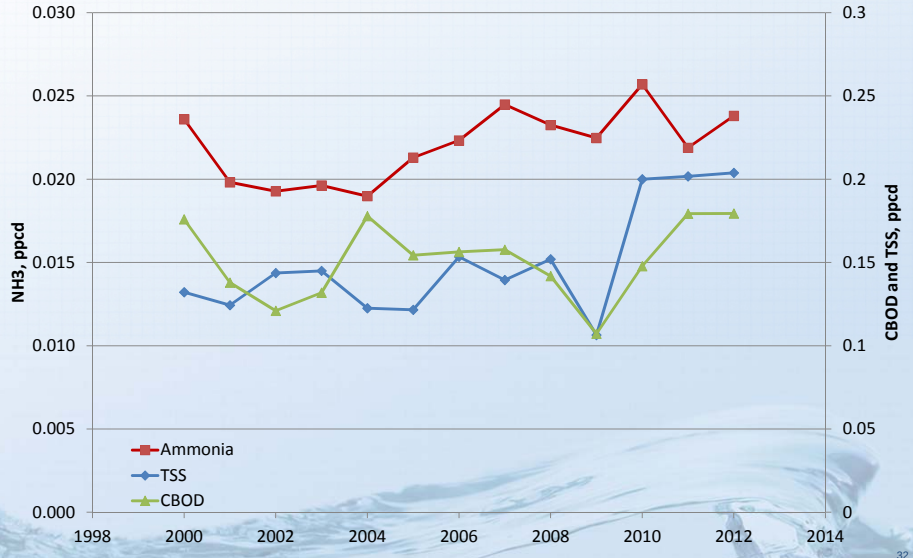
Max Month Ammonia Projections



Ammonia Projections

Flow	2015	2025	2035
ADW	3,100	3,300	3,400
AA	3,200	3,300	3,500
MM	4,000	4,200	4,400
PD	4,900	5,200	5,400

Does this account for rapid growth in ammonia?



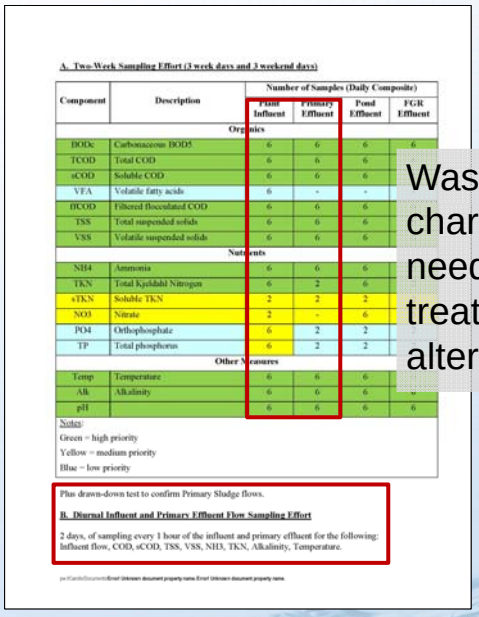
Possible Explanations for Increased Ammonia Per Capita…

- Conservation yielding lower flows and thus longer residence times in the collection system and more time for conversion of organic N → ammonia
  - Would anticipate that the TKN per capita load to the plant would not increase
  - No influent TKN data from 2004 – 2007 to validate this idea
- Disproportionate increase in commercial relative to residential population
  - Wastewater from an office complex will be relatively dilute with respect to BOD and TSS but more concentrated in ammonia
  - The majority of the ammonia load comes from toilet flushing (~80%), while only ~40% of TSS and ~25% of BOD loads come from toilet flushing

Alternate Method to Project Ammonia Loads

- Calculate an ammonia equivalent residential unit (ERU) factor for the employment population, starting with the following assumptions:
  - The majority of the employment wastewater will be generated by toilet flushing (as opposed to showers and garbage disposals) ~ 78% of residential ammonia load
  - Employees spend 40 hours per week or 36% of waking time at work
  - 1 employee = 0.36 * 0.78 or 0.28 ERUs
- Calculate historical ERUs = Residential population + 0.28 * Employment population
- Calculate historical per ERU loads (lb/ERU-d)
- Use the projected population and employment data along with the calculated per ERU loads to project ammonia loads

Sampling Effort



A. Two-Week Sampling Effort (3 week days and 3 weekend days)

Component	Description	Number of Samples (Daily Composite)			
		Plant Influent	Primary Effluent	Pond Effluent	FGR Effluent
Organics					
BODc	Carbonaceous BOD5	6	6	6	6
TCOD	Total COD	6	6	6	
sCOD	Soluble COD	6	6	6	
VFA	Volatile fatty acids	6	-	-	
fCOD	Filtered flocculated COD	6	6	6	
TSS	Total suspended solids	6	6	6	
VSS	Volatile suspended solids	6	6	6	
Nutrients					
NH4	Ammonia	6	6	6	
TKN	Total Kjeldahl Nitrogen	6	2	6	
sTKN	Soluble TKN	2	2	2	
NO3	Nitrate	2	-	6	
PO4	Orthophosphate	6	2	2	
TP	Total phosphorus	6	2	2	
Other Measures					
Temp	Temperature	6	6	6	
Alk	Alkalinity	6	6	6	
pH		6	6	6	6

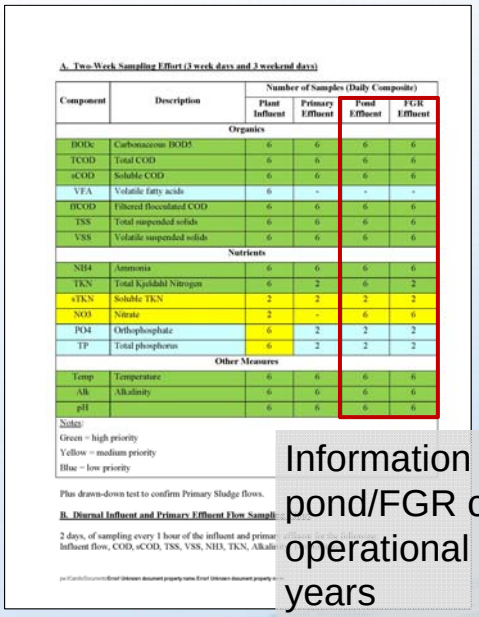
Notes:
Green = high priority
Yellow = medium priority
Blue = low priority

Plus drawn-down test to confirm Primary Sludge flows.

B. Diurnal Influent and Primary Effluent Flow Sampling Effort

2 days, of sampling every 1 hour of the influent and primary effluent for the following: Influent flow, COD, sCOD, TSS, VSS, NH3, TKN, Alkalinity, Temperature.

Wastewater characterization needed for secondary treatment alternatives analysis



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TSS	Total suspended solids	6	6	6	6
VSS	Volatile suspended solids	6	6	6	6
Nutrients					
NH4	Ammonia	6	6	6	6
TKN	Total Kjeldahl Nitrogen	6	2	6	2
sTKN	Soluble TKN	2	2	2	2
NO3	Nitrate	2	-	6	6
PO4	Orthophosphate	6	2	2	2
TP	Total phosphorus	6	2	2	2
Other Measures					
Temp	Temperature	6	6	6	6
Alk	Alkalinity	6	6	6	6
pH		6	6	6	6

Notes:
Green = high priority
Yellow = medium priority
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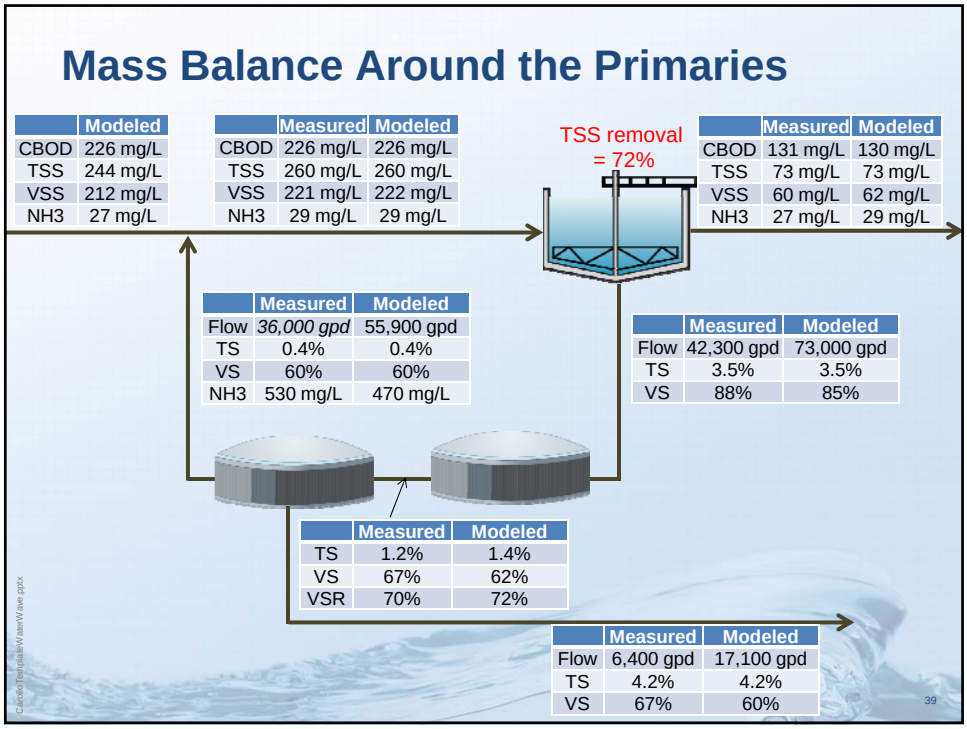
2 days, of sampling every 1 hour of the influent and primar
Influent flow, COD, sCOD, TSS, VSS, NH3, TKN, Alkali

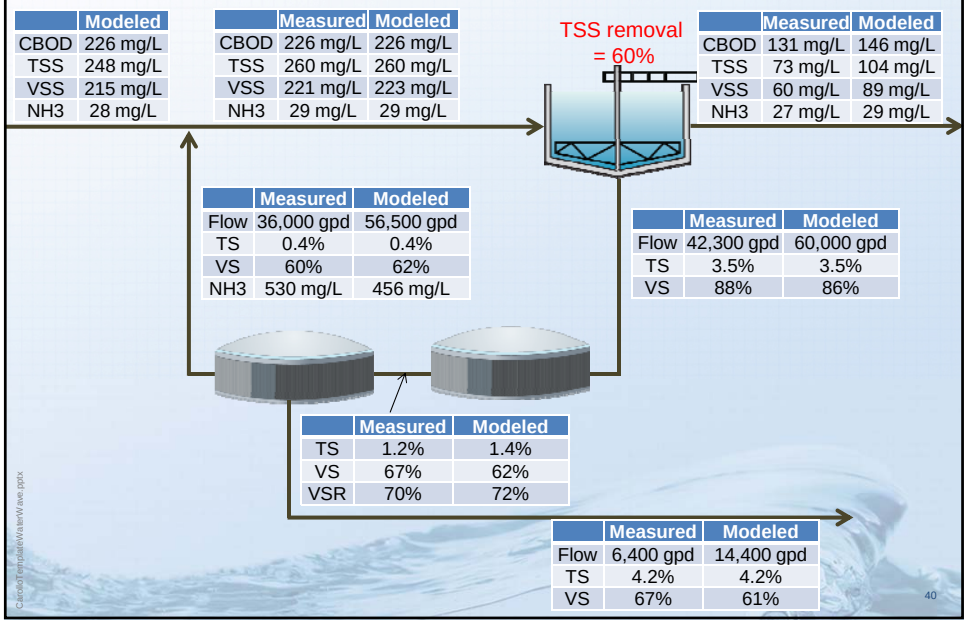
Information on the current pond/FGR configuration for operational assistance next 8± years

Parking Lot

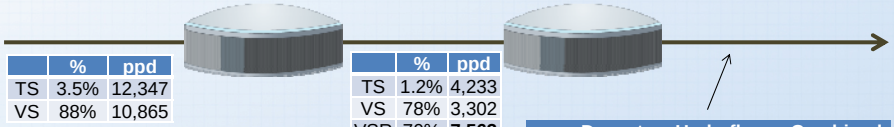
Mass Balance Around the Primaries



Mass Balance Around the Primaries



Mass Balance Around the Digesters



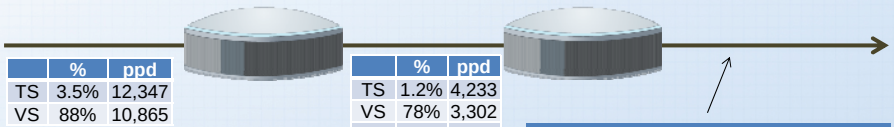
	%	ppd
TS	3.5%	12,347
VS	88%	10,865

	%	ppd
TS	1.2%	4,233
VS	78%	3,302
VSR	70%	**7,563**

	Decant		Underflow		Combined	
	%	ppd	%	ppd	%	ppd
TS	0.4%	1,212	4.2%	2,249	1%	3,461
VS	**60%**	729	67%	1,511	65%	2,241
VSR					32%	**1,061**

	Measured	Modeled
VSR, ppd	8,624	13,400
Gas Production, cf/d	177,000	177,000
Gas Production rate, cf/lb	21	13

Mass Balance Around the Digesters



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VSR					32%	**1,061**

	Measured	Modeled 72%	Modeled 60%
VSR, ppd	8,624	13,400	11,200
Gas Production, cf/d	177,000	177,000	177,000
Gas Production rate, cf/lb	21	13	16

APPENDIX C – MEETING NOTES – JUNE 27, 2013

Engineers...Working Wonders With Water™

CONFERENCE MEMORANDUM

Project:	Master Plan and Primary Treatment Design	**Conf. Date:**	June 27, 2013
Client:	City of Sunnyvale	**Issue Date:**	July 9, 2013
Location:	WPCP Conference Room		
Attendees:	City: Craig Mobeck, Bhavani Yerrapotu, Kapil Verma, Alo Kauravlla EOA, Inc: Ray Goebel	Carollo/HDR: Jim Hagstrom, Jamel Demir, Jan Davel, Anne Conklin	
Purpose:	Review data request status and preliminary findings.		
Distribution:	Attendees, Bryan Berdeen	**File:**	9265A.00

Discussion:
The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

Overview of Preliminary Findings

1. The additional data Carollo has requested is to meet two objectives, 1) improve load projections, and 2) characterize the influent wastewater for process modeling.

2. Overall, some parameters show a difference between the last two years compared to the data assumed for the SIP, and also the default range of numbers. Some of these can be updated with focused, concentrated sampling efforts. City/Carollo would want to make sure that the sampling protocols are in place that would ensure the newly obtained data would provide more accurate data (not simply repeat any prior errors).

3. Flow:
   A. Average annual flow has been trending down.
   B. Per capita flows have been dropping also. As part of the analysis, Carollo added in the industrial data, and subtracted that from the total to identify the residential component. Alo: These data actually go really far back, so this information could be updated with more than only the last year's data. Probably okay to apply the last year's industrial data to all the years. The collection system report has information to distinguish between the true residential and commuter population numbers. The potential impact of accepting Cupertino's flow to the WPCP base flow needs to be discussed with the City as to how this gets factored into the long-term planning assumptions.
   C. Comparison of per capita flows are reasonable when compared to other plants. These numbers are also within the default range of 80 – 100 mgd. SIP had assumed 105 gpcd, which was probably reasonable for the time-frame when that work was conducted

D. Carollo is recommending 89 gpcd, based on the level of evaluation done so far. This can be updated if more information comes available as we move forward with the project.

E. Kapil: Were there some significant City-wide conservation efforts implemented over the last years? Jamel: We're starting to see those kinds of efforts leveling out, now that Cities are nearing completion of their conservation efforts. Drought impacts could start impacting this, though, so that could be the driver for even lower per capita numbers.

4. TSS:
   A. In 2009 the location of the influent sampler changed (as well as the type of sampler used). Periodic flushing (whole pipe systems) of the system really started during this time also, so it could be a combination of these things. The City did not perform any grab sampling data for that period, either. Could be that the material liberated from the pipelines would settle out easily in the primaries, which is why the primary effluent did not mirror this dramatic increase in TSS.
   B. Would be good to know the number of clarifiers online. Ray: Typically they run with around 7 clarifiers, not all 10. City will confirm this.
   C. Per capita TSS loads have increased from around 0.15, which is really low, to 0.20 ppcd after 2010. Anne: Recent data are more in the range we would expect.
   D. Primary sed basin removal efficiency is high after 2009, i.e., 70+% vs. the more typical 60%. This is one of data that could be checked as part of the two week focused data analysis. Kapil: The decant stream from the digesters usually goes to the ponds, except for the last few months, where the entire stream is routed back to the headworks. This applies to the dewatering decant also, which has always gone to the ponds. Bhavani: The info on this is still somewhat contradictory – City will get back to Carollo on this. Ray: I've always understood it goes to the headworks, not the pond.
   E. Mass balance around the primary clarifiers shows the measured primary sludge matches very well the calculated primary sludge removal up until after 2009, when the sampler was moved. Anne: Does the scum from primaries blend with the primary sludge? Ray: Believe so, but not sure if it's the same pump, though. These are independent measurements.
   F. Jamel: Sludge flow measurement can sometimes be difficult to accurately quantify based on pump run times. For instance, when they logged the minutes of operation, did they record the number of pumps operating? Kapil: We do see minor differences in pump durations, which would suggest the true operation is likely being logged. Ray: The density numbers don't correlate well, either. Jamel: Did digester gas production increase when TSS increased? Carollo to review gas data to determine.
   G. Anne: The hauled dried digester solids could also be a way to provide some correlation of solids production. Ray: We've never really been able to make that mass balance work, either.
   H. Jim: Suggest we proceed with using the per capita of 0.20, since it's not really going to impact our evaluations later on in the process. If the estimate is low, it could impact the digester requirements and the secondary clarifier requirements. We could come back later and tweak this if necessary. Bhavani: If it impacts the $318 million number we'll have to go back and evaluate the impacts of this. Ray: Gas production numbers have always been suspiciously high, which would corroborate the higher TSS numbers. It's primary sludge, though, which would support the higher level of destruction.
   I. The SIP initially used 0.13 ppcd for TSS and later data suggested using 0.20 ppcd, which is consistent with the recommended value.

5. VSS Fraction:
   A. The data analysis indicated slightly higher than expected the averages (VSS/TSS ratio of 0.86). The possible digester decant (if returned to the headworks) would not explain this, since the VSS fraction would already have been reduced in the digester.
   B. Jim: How about landfill leachate? Ray: No, don't see this as possible.
   C. The SIP review assumed a VSS/TSS ratio that was a little lower (0.75).
   D. Carollo will also check these values for San Jose and Palo Alto, but likely will use the ratio as determined.

6. CBOD:
   A. The per capita CBOD loads seem pretty reasonable, especially after 2010 where they appear more typical. A per capita value of 0.18 ppcd is right in the range Carollo would expect to see.
   B. As far as removal efficiencies across the primaries, we would expect to see around 30% (low before 2010, but higher after 2010). There are factors that impact this, e.g., the soluble component of the BOD.
   C. Carollo can move ahead with using the 45% removal rate for CBOD. This is a little aggressive, but can be modified if any further information becomes available.

7. Ammonia:
   A. Good correlation between influent and primary effluent.
   B. The grab samples are higher than the composite sample, which could be suggesting a high diurnal fluctuation. Might lead to requiring some level of diurnal ammonia equalization (possibly of the dewatering return stream).
   C. Even though the concentrations are going up over time, the loads are going up much less dramatically.
   D. An industrial source would typically explain why per capita ammonia numbers go up. We've seen this in other cities. We should talk about this at the next meeting. Alo: The lab procedure may have changed, i.e., possibly did not analyze immediately, although the samples were preserved. Data from earlier years likely to be more accurate.
   E. Calculated values are within the expected range, but it would be good to keep watching this. It is possible that the impacts of employment population data has not properly assessed. The WPCP could be experiencing high influent loadings during the day because of the daily employment migration into Sunnyvale. City/Carollo to evaluate further.
   F. If the digester decant has been going to the headworks, that would be contributing around 7% to the nitrogen loading.

8. TKN:
   A. Ratio is a little high. This could be explained if the digester decant is in fact being returned to the headworks.

9. Overall:
   A. Jim: If the City is relatively comfortable with this summary, suggest we use the next meeting to focus instead on the way forward for sampling.

Review Status of Data Requests

1. Influent:
   A. Peak hour flows. This may be in the information that's typically collected. The SIP evaluation reported some peaking factors, which must have been based on data from the plant. Jamel: Possible some of this information is being developed as part of the collection system work (Craig to check).
   B. Temperature. Typically checked on the daily grab sheets. However, this may have fallen through the cracks (it's not on the Sunlab report). Carollo proposed to use temperature data from other local agencies (suggest that this data collection start again). Kapil: The pond effluent flows are instantaneous on certain sheets, and don't agree with the composites.
   C. Flow: City confirmed that the effluent flows do not include the reuse component, i.e., this would have to be added in to reflect total flows through DAFTs and filters.

2. Primaries in operation: six to seven primaries typically in operation, but this should be confirmed with the plant operations staff.

3. Energy: Kapil will check to see how to get Carollo this data. CDM has base data already summarized as part of the work they recently completed for the City (Arvind Akela on vacation - City will reach out to him for this information).

Next Steps

1. If City shares the opinion that these data are sufficient for the flow and load determination, Carollo would like to focus in the next meeting on the sampling protocols instead, which includes the 2-week focused sampling effort.

2. Bhavani: Would like Carollo to look at the detailed nitrification data (City to send) and give the City some initial feedback on this.

3. Carollo to get Bob Gillette onsite to review the sampling approaches being used (before the next flow & loads meeting).

4. City needs to verify the population projections (i.e., look at the recent report which shows the zones, etc). The sewer draft plan has been accepted.

Action Items

Added to the Action Item log.

Prepared By:

J.L. Davel

JLD:JLD

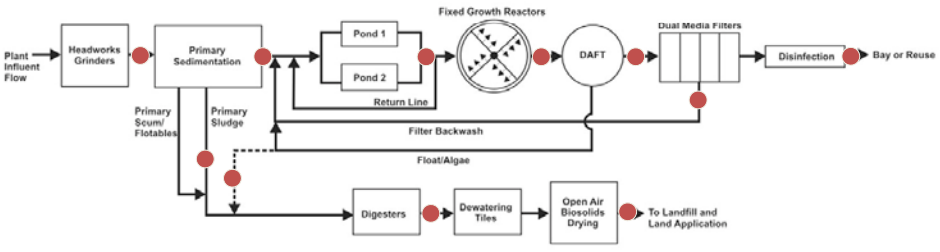
This Meeting will be a Success if …

- ✓Verify status of data request
- ✓Verify how data relates to the flow streams
- ✓Obtain City feedback on data observations

Agenda

1. Preliminary findings form data received
2. Review status of data request
3. Next Steps/Action Items

Flow Schematic and Sampling Locations



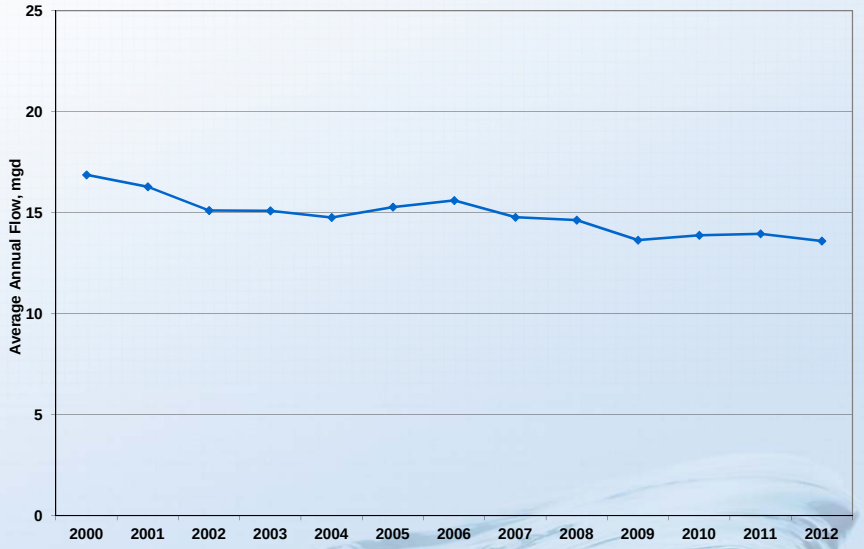
Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
Flow	80 – 100 gpcd	105 gpcd	89 gpcd
TSS	0.2 ppcd	0.13 ppcd	0.2 ppcd
VSS / TSS	0.8 – 0.85	0.75(1)	0.86
CBOD	0.17 – 0.2 ppcd	0.16 ppcd	0.18 ppcd
NH3	0.02 ppcd	0.02 ppcd	0.023 ppcd
NH3 / TKN	0.6 – 0.7	0.60(1)	0.78

Notes:
(1) SIP Peer Review, assumed.

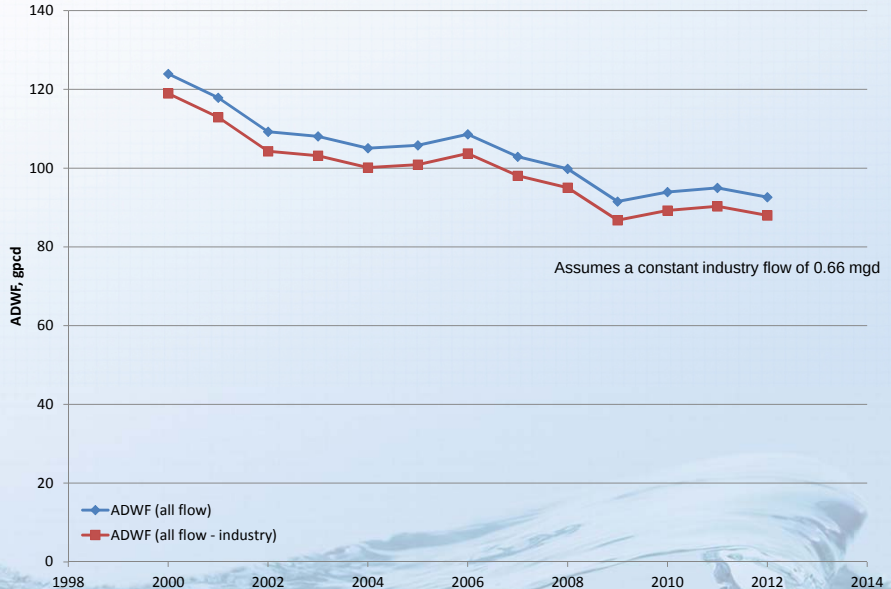
Flow

Flow



7

Per Capita Flow Projections



8

Per Capita Flow Comparison

Facility Name	State	Per Capita Flow, gpcd	Residential Per Capita Flow, gpcd
Palo Alto	CA	98	
Sunnyvale	CA	94	89
West County	CA	86	
San Jose	CA	85	
Rock Creek	OR		83
San Mateo	CA	83	
Oak Harbor	WA		79

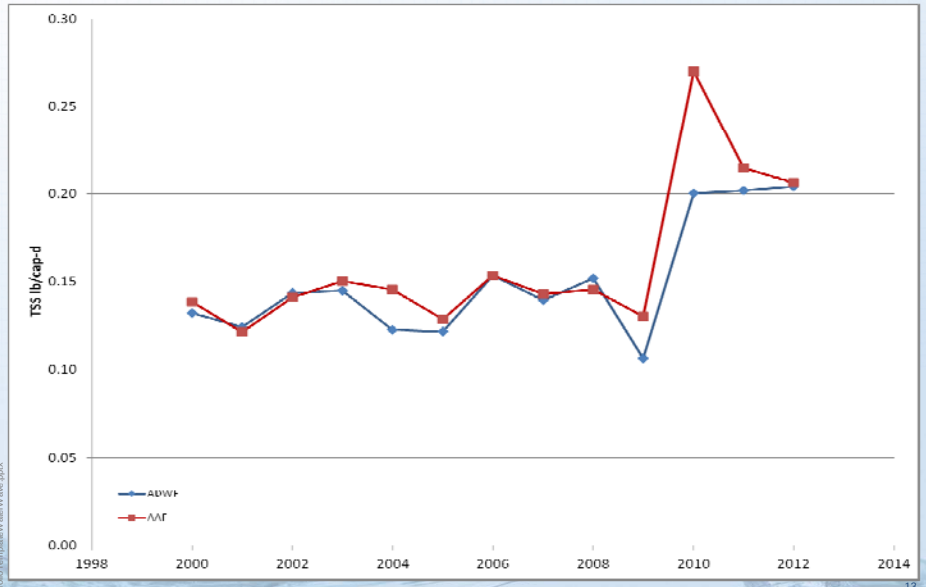
Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
Flow	80 – 100 gpcd	105 gpcd	89 gpcd
TSS			
VSS / TSS			
CBOD			
NH3			
NH3 / TKN			

TSS

Average Annual TSS

Per Capita Load



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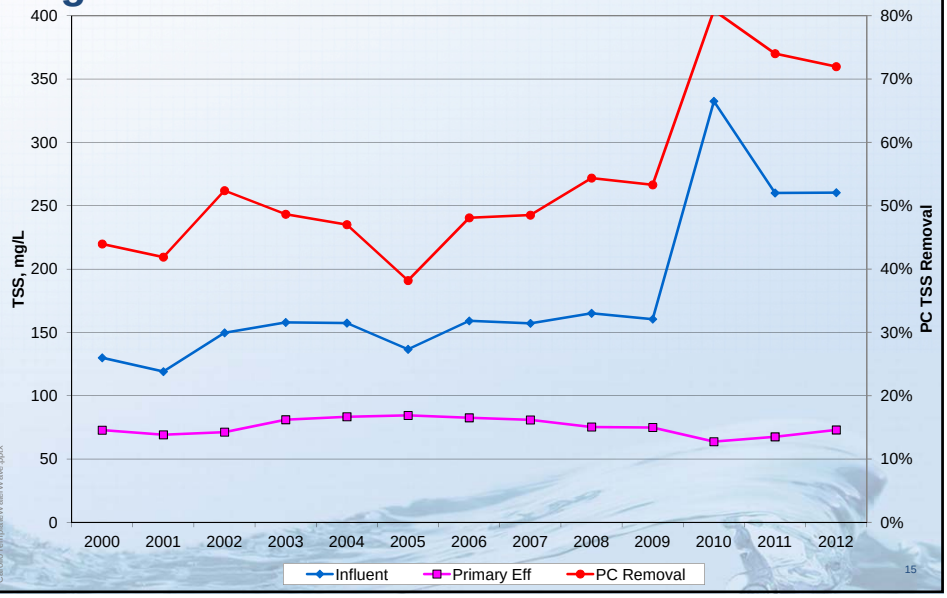
Per Capita TSS Comparison

Facility Name	State	Per Capita TSS Load, ppcd	
		ADW	AA
West County	CA	0.22	
San Mateo	CA	0.21	
Sunnyvale – 2011-2012 Data	CA	0.20	0.20
Sunnyvale – SIP	CA	0.13	*0.15*
Sunnyvale – SIP Peer Review	CA	0.21	*0.25*
Palo Alto	CA	0.19	
San Jose	CA	0.19	
Rock Creek	OR		0.21(1)
Oak Harbor	WA		0.17(2)

Notes:
(1) Excludes industry.
(2) No industry in service area.

14

Very Low Removal Prior to 2009 and Very High Removals After 2009



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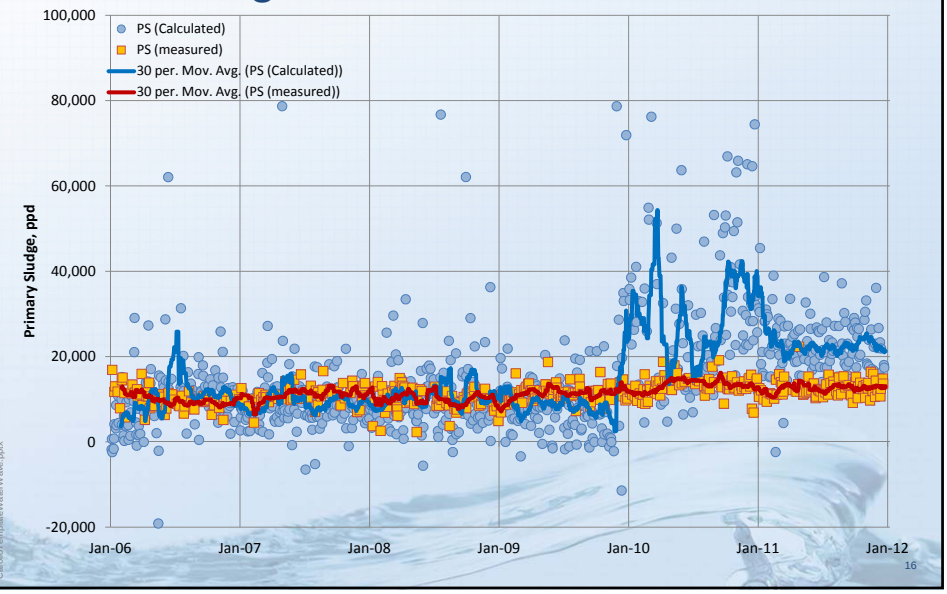
Primary Sludge Production Prior to 2010 Seems to Agree Better with Plant Data



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TSS Comparison

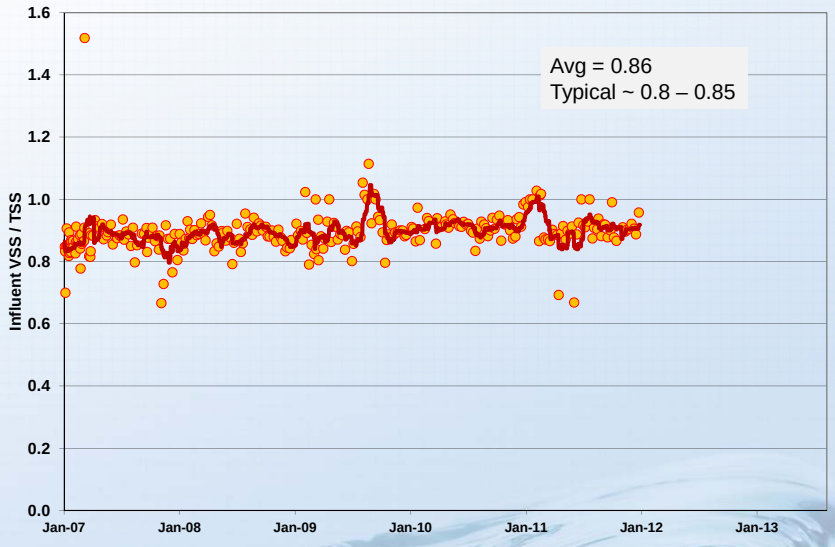
Parameter	Default	SIP Data	2011-2012 Data
Per capita	0.2	0.13	0.2
PC Removal	60%	45 – 50%	72%
Mass Balance		< 10% difference	~75% difference

Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
Flow	80 – 100 gpcd	105 gpcd	89 gpcd
TSS	0.2 ppcd	0.13 ppcd	0.2 ppcd
VSS / TSS	0.8 – 0.85		
CBOD	0.17 – 0.2 ppcd		
NH3	0.02 ppcd		
NH3 / TKN	0.6 – 0.7		

VSS

VSS / TSS


Avg = 0.86
Typical ~ 0.8 – 0.85
Influent VSS / TSS
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13

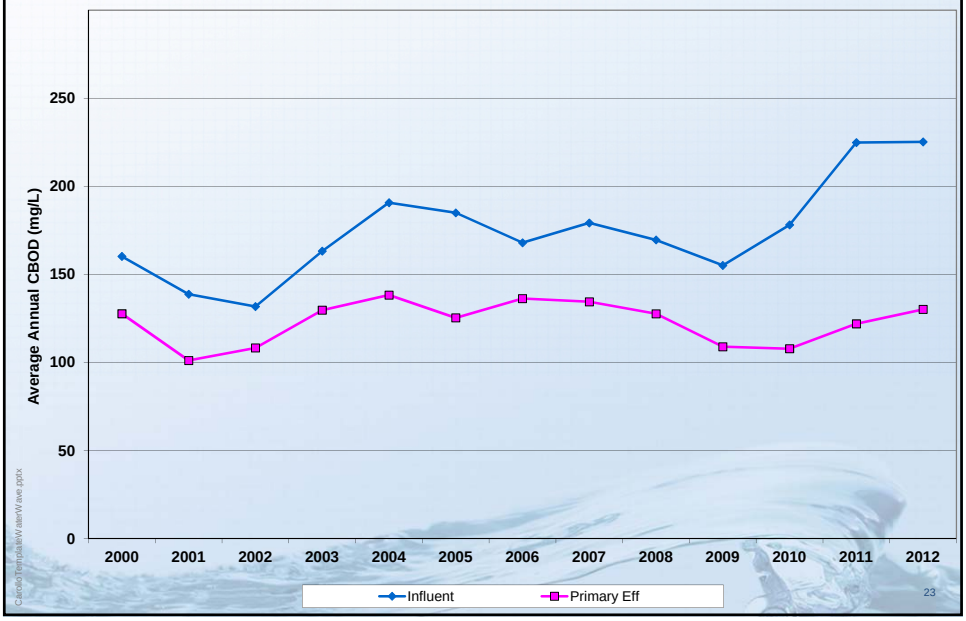
Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
Flow	80 – 100 gpcd	105 gpcd	89 gpcd
TSS	0.2 ppcd	0.13 ppcd	0.2 ppcd
VSS / TSS	0.8 – 0.85	0.75(1)	0.86
CBOD	0.17 – 0.2 ppcd		
NH3	0.02 ppcd		
NH3 / TKN	0.6 – 0.7		

Notes:
(1) SIP Review, assumed.

CBOD

CBOD



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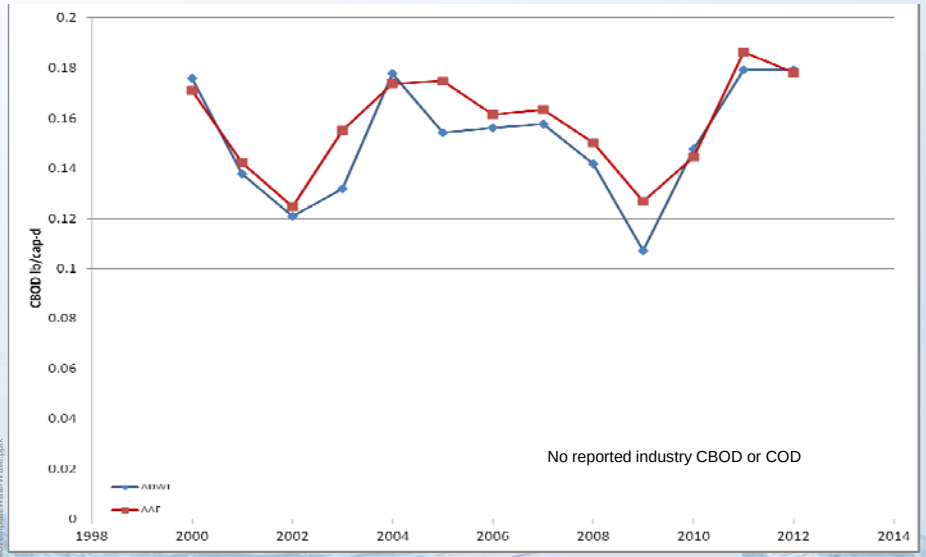
Per Capita Load



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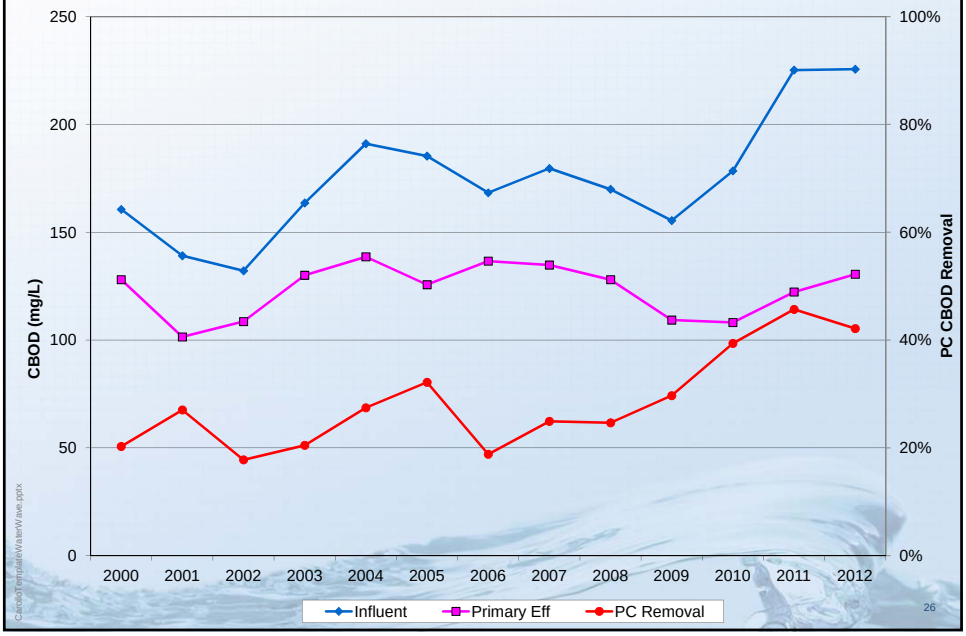
Per Capita CBOD Comparison

Facility Name	State	Per Capita CBOD Load, ppcd	
		ADW	AA
West County	CA	~0.19 (BOD = 0.22)	
Sunnyvale – 2011-2012 Data	CA	0.18	0.18
Sunnyvale – SIP	CA	0.16	*0.17*
Sunnyvale – SIP Peer Review	CA	0.16	*0.19*
San Mateo	CA	0.18	
San Jose	CA	~0.18 (BOD = 0.21)	
Palo Alto	CA	~0.17 (BOD = 0.20)	
Rock Creek	OR		0.20(1)
Oak Harbor	WA		0.17(2)

Notes:
(1) Excludes industry.
(2) No industry in service area.

High CBOD Removal in Last Few Years



CBOD Comparison

Parameter	Default	SIP Data	2011-2012 Data
Per capita	0.2	0.16	0.18
PC Removal	60%	20 – 30%	45%

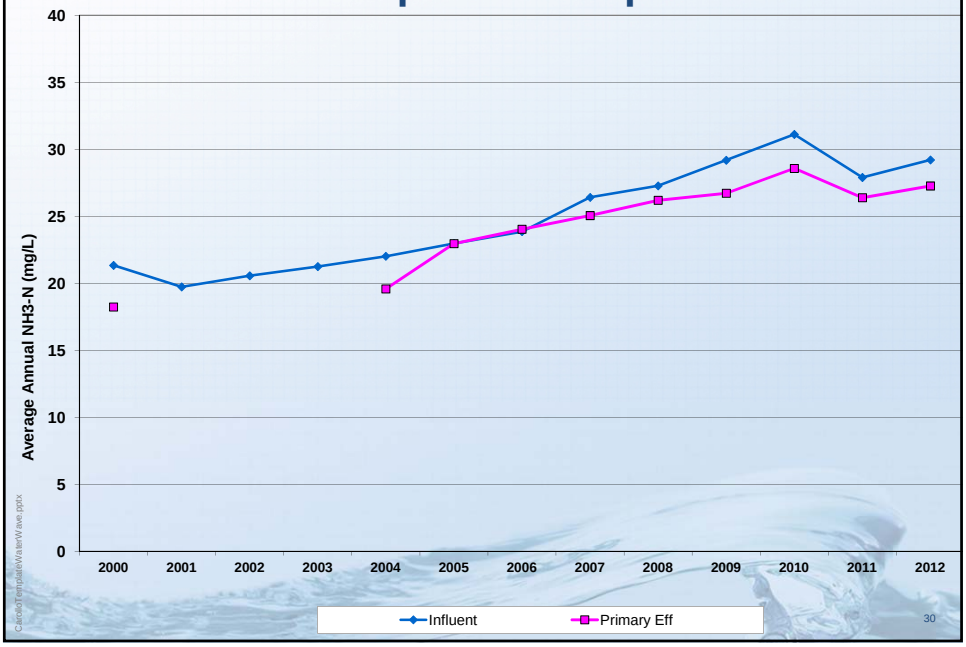
Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
Flow	80 – 100 gpcd	105 gpcd	89 gpcd
TSS	0.2 ppcd	0.13 ppcd	0.2 ppcd
VSS / TSS	0.8 – 0.85	0.75(1)	0.86
CBOD	0.17 – 0.2 ppcd	0.16 ppcd	0.18 ppcd
NH3	0.02 ppcd		
NH3 / TKN	0.6 – 0.7		

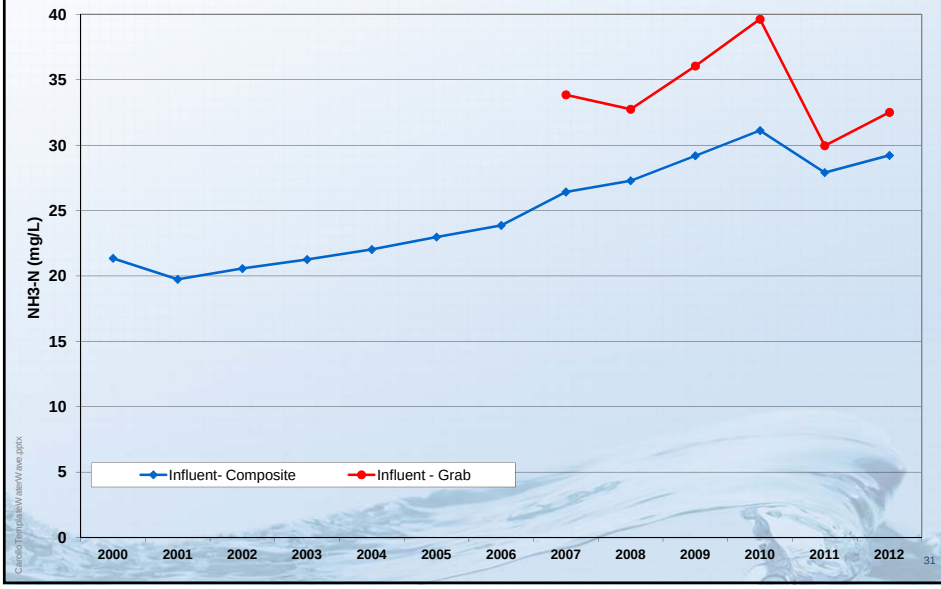
Notes:
(1) SIP Review, assumed.

Ammonia

Ammonia – Composite Sample



Comparison Between Composite and Grab Samples



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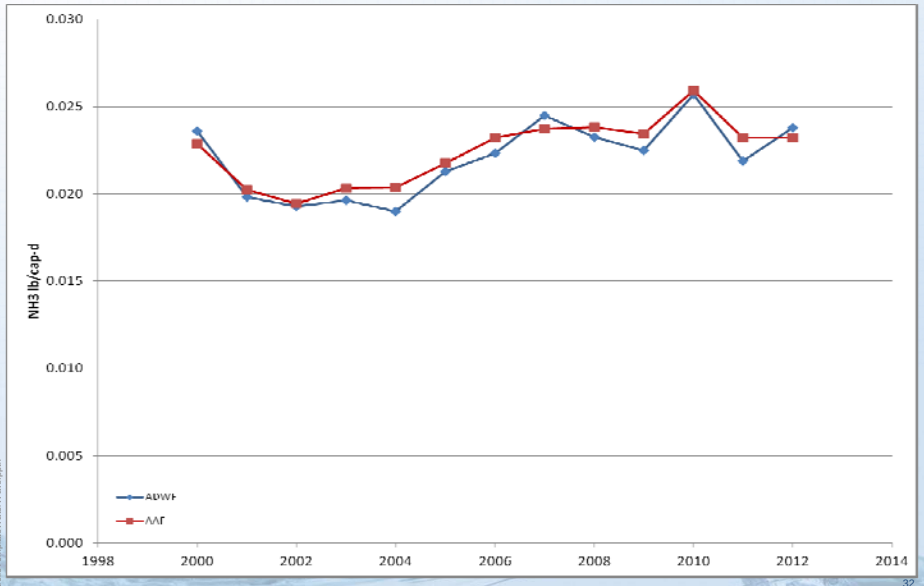
Per Capita Load



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Per Capita NH3-N Comparison

Facility Name	State	Per Capita CBOD Load, ppcd	
		ADW	AA
Palo Alto	CA	0.024	
Sunnyvale – 2011-2012 Data	CA	0.023	0.023
Sunnyvale – SIP	CA	0.02	*0.025*
Sunnyvale – SIP Peer Review	CA	0.017	*0.02*
San Jose	CA	0.018	
West County	CA	0.016	
Rock Creek	OR		0.02(1)
Oak Harbor	WA		0.022(2)

Notes:
(1) Excludes industry.
(2) No industry in service area.

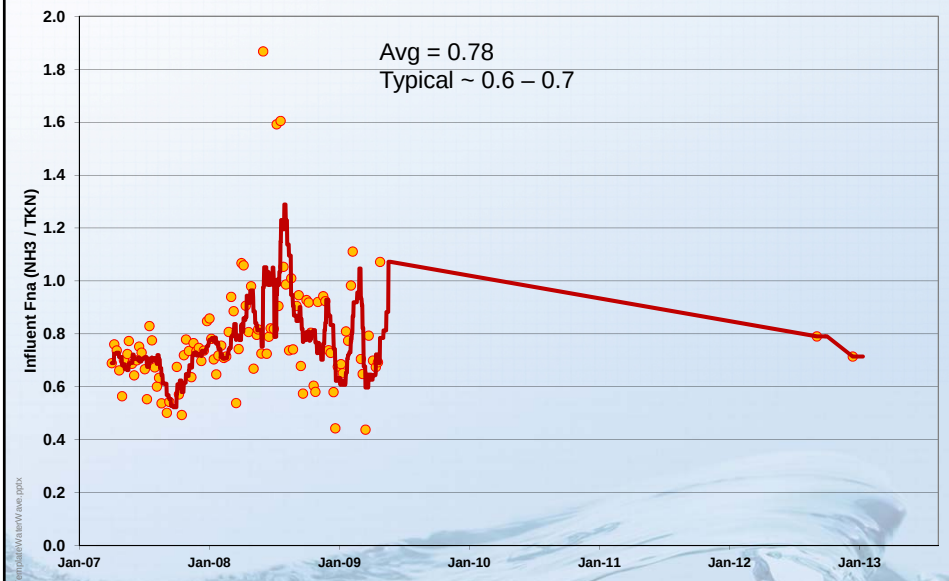
Comparison of Influent Data with Industry Parameters

Parameter	Default	SIP Data	2011-2012 Data
Flow	80 – 100 gpcd	105 gpcd	89 gpcd
TSS	0.2 ppcd	0.13 ppcd	0.2 ppcd
VSS / TSS	0.8 – 0.85	0.75(1)	0.86
CBOD	0.17 – 0.2 ppcd	0.16 ppcd	0.18 ppcd
NH3	0.02 ppcd	0.02 ppcd	0.023 ppcd
NH3 / TKN	0.6 – 0.7		

Notes:
(1) SIP Review, assumed.

TKN

Influent Ammonia Fraction of TKN



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NH3	0.02 ppcd	0.02 ppcd	0.023 ppcd
NH3 / TKN	0.6 – 0.7	0.6(1)	0.78

Notes:
(1) SIP Review, assumed.

Status of Data Request

Data Still Needed From City

Process Area	Parameter
Plant Influent	Peak flows
	Temperature (on lab daily grab sheets?)
	Digester decant (routing)
Primary Clarification	Number of primary clarifiers online
Energy	NG, LFG, power etc. (will follow up with Pat L.)

Next Steps

Next Steps

- Confirm planning level values
- Develop focused sampling protocols